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[54] **SYSTEM FOR ADJUSTING HYPERTEXT LINKS WITH WEIGHED USER GOALS AND ACTIVITIES**

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Related U.S. Application Data

[63] Continuation of Ser. No. 841,965, Feb. 26, 1992, abandoned.

[51] **Int. Cl.**[6] **G06F 17/30**

[52] **U.S. Cl.** **395/600**; 364/DIG. 1; 364/282.2; 364/282.3; 364/274

[58] **Field of Search** 395/600

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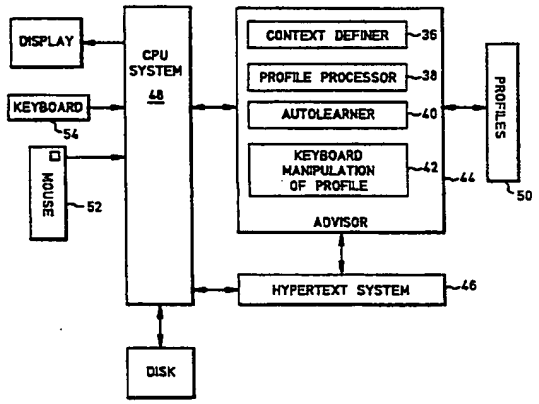
[57] **ABSTRACT**

A smart hypermedia system that acquires user characteristics either directly or inferentially. Simple associative networks serve to model user profiles, including relationships between user goals and the hypermedia information nodes. Hypermedia links to other nodes are recommended by ranking a link list in an order that depends on one or more user profiles containing information relating to users' goals and interests. Users can teach the system directly by rearranging the order of suggested links on the list. The system can also learn indirectly by observing how long and in what sequence the user views each hypermedia information node. User profiles can be combined to form group profiles and may be dynamically and continuously updated to form an adaptive system profile. The two system learning modes may be simultaneous or disjoint.

29 Claims, 5 Drawing Sheets



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TOPIC → / TOPIC ↓	VEGETARIANISM	SURFING	NUTRITION	STEEL-WORKING
Vegetarianism	x	3	10	1
Surfing	x	x	5	1
Nutrition	x	x	x	4
Steel-Working	x	x	x	x

12

10

FIG. 1

TOPIC → / GOAL ↓	VEGETARIANISM	SURFING	NUTRITION	STEEL-WORKING
Learning about California Lifestyles	10	7	10	2
Get Healthy	5	10	2	1
Find a job in Pittsburgh	1	3	1	10

FIG. 2

14

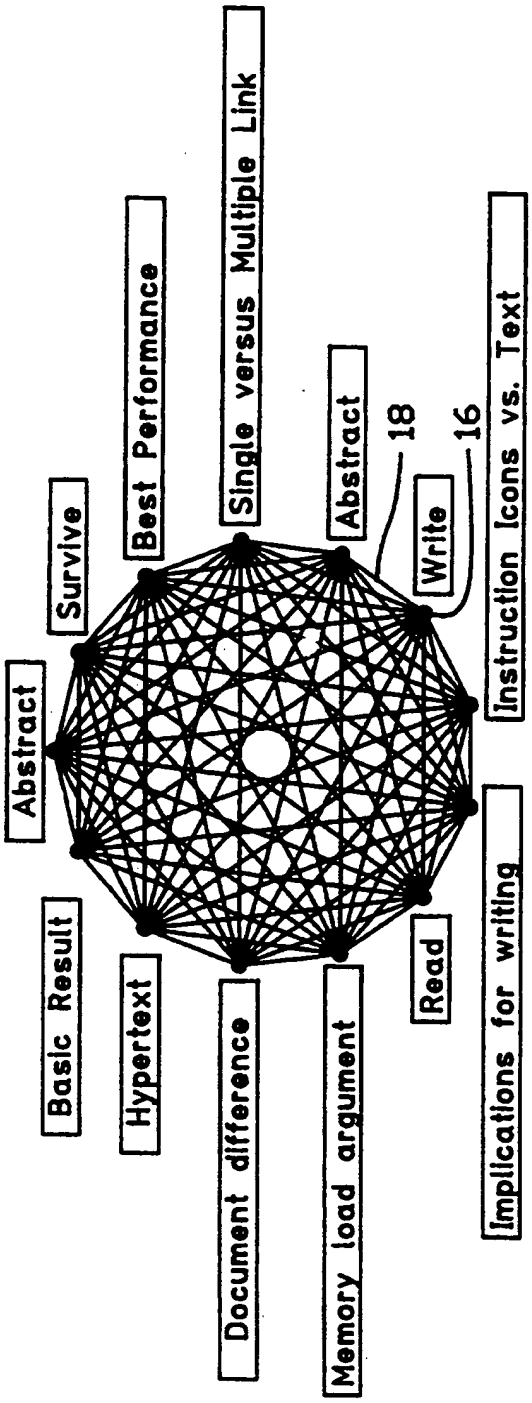

Single versus Multiple Link
Best Performance
Survive
Abstract
Basic Result
Hypertext
Document difference
Memory load argument
Read
Implications for writing
Write
Abstract
Instruction Icons vs. Text
18
16

FIG. 3

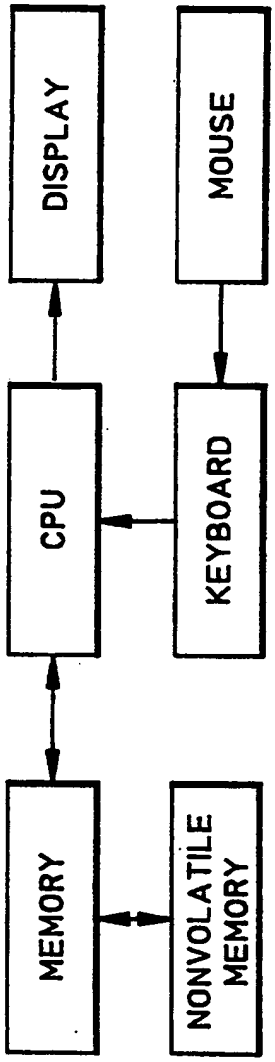

DISPLAY
MOUSE
CPU
KEYBOARD
MEMORY
NONVOLATILE MEMORY

FIG. 5

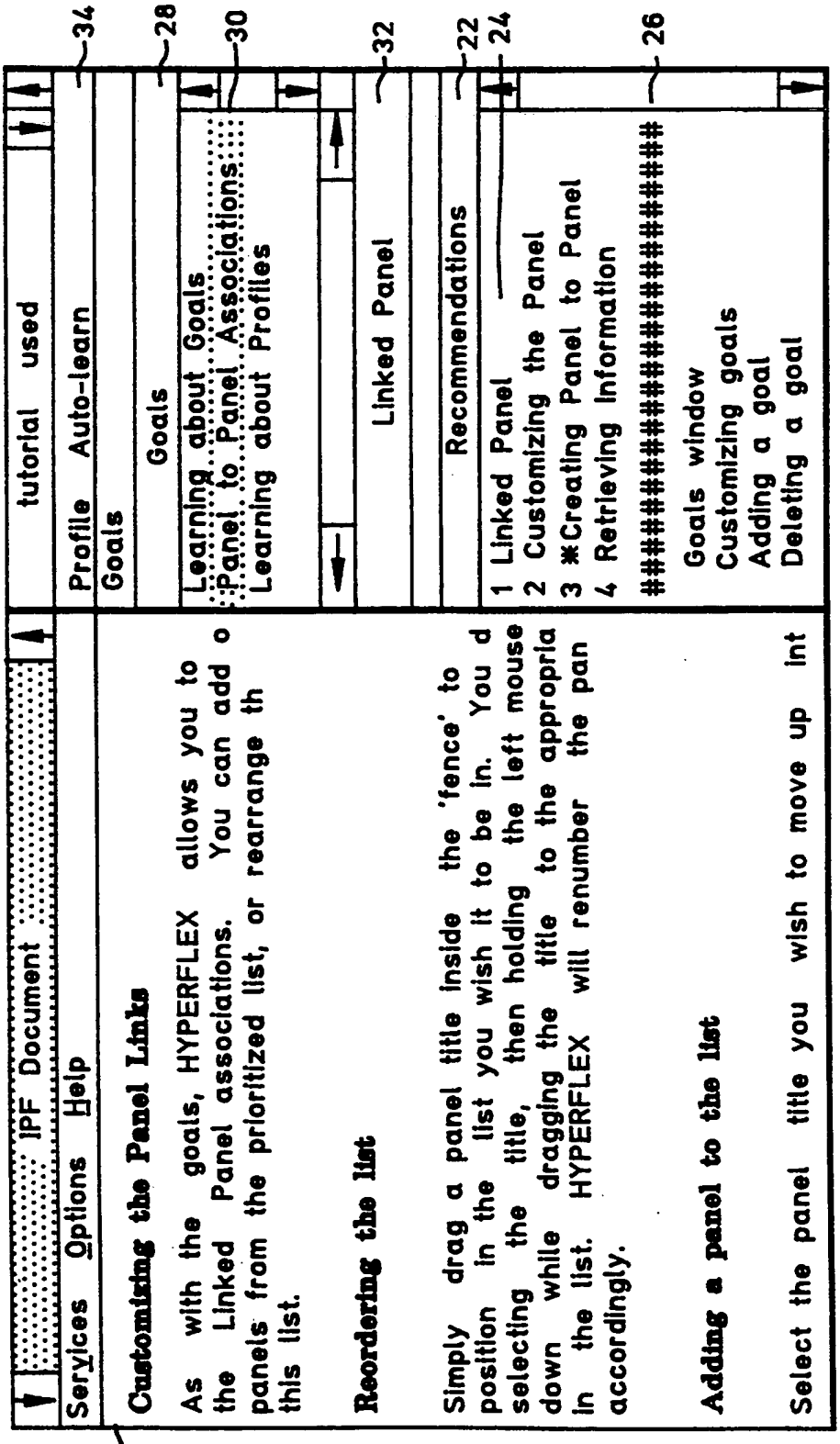

IPF Document
Services Options Help
Customizing the Panel Links
As with the goals, HYPERFLEX allows you to
the Linked Panel associations. You can add o
panels from the prioritized list, or rearrange th
this list.
Reordering the List
Simply drag a panel title inside the 'fence' to
position in the list you wish it to be in. You d
selecting the title, then holding the left mouse
down while dragging the title to the appropria
in the list. HYPERFLEX will renumber the pan
accordingly.
Adding a panel to the List
Select the panel title you wish to move up int
tutorial used
Profile Auto-learn
Goals
Goals
Learning about Goals
Panel to Panel Associations
Learning about Profiles
Linked Panel
Recommendations
1 Linked Panel
2 Customizing the Panel
3 *Creating Panel to Panel
4 Retrieving Information
##########################
Goals window
Customizing goals
Adding a goal
Deleting a goal
20
22
24
26
28
30
32
34

FIG. 4

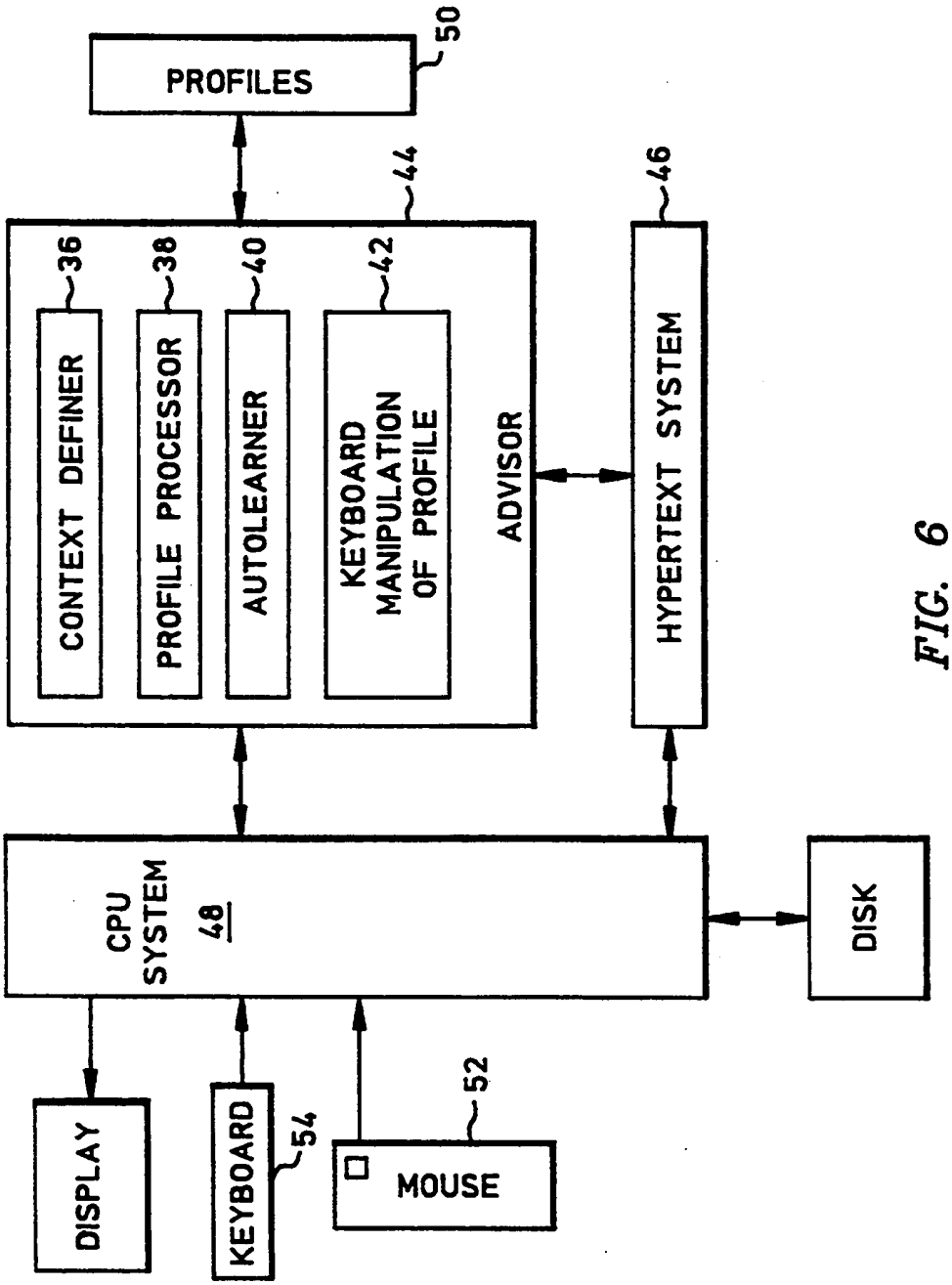
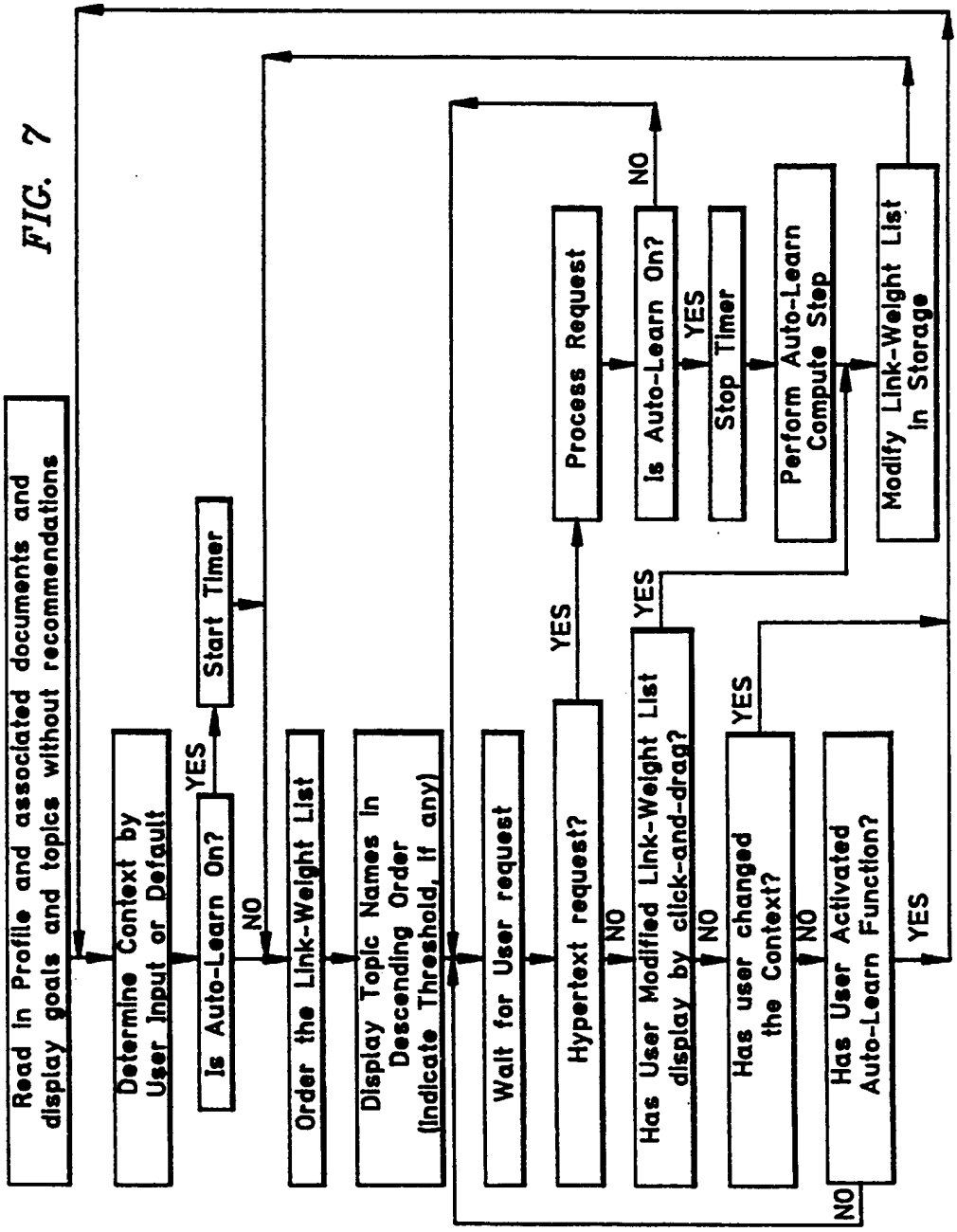

PROFILES
50
44
46
36
38
40
42
CONTEXT DEFINER
PROFILE PROCESSOR
AUTOLEARNER
KEYBOARD MANIPULATION OF PROFILE
ADVISOR
HYPERTEXT SYSTEM
CPU SYSTEM 48
DISK
DISPLAY
KEYBOARD
54
52
MOUSE

FIG. 6

FIG. 7


Read in Profile and associated documents and display goals and topics without recommendations
Determine Context by User Input or Default
Is Auto-Learn On?
YES
NO
Start Timer
Order the Link-Weight List
Display Topic Names in Descending Order (Indicate Threshold, if any)
Wait for User request
Hypertext request?
YES
NO
Process Request
Is Auto-Learn On?
NO
YES
Stop Timer
Perform Auto-Learn Compute Step
Modify Link-Weight List in Storage
Has User Modified Link-Weight List display by click-and-drag?
YES
NO
Has user changed the Context?
YES
NO
Has User Activated Auto-Learn Function?
YES
NO

SYSTEM FOR ADJUSTING HYPERTEXT LINKS WITH WEIGHED USER GOALS AND ACTIVITIES

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a 37 CFR§1.62 File-Wrapper Continuation of parent application Ser. No. 07/841,965 filed on Feb. 26, 1992 and now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to user interface techniques for reorganization of retrieved documents and, more particularly, to an intelligent hypermedia system that adapts dynamically to the user.

2. Discussion of the Related Art

Hypermedia systems that allow the user to navigate through large amounts of on-line information are known to be a promising method for controlling the overwhelming increase in information available to the user. While most paper documents lead the user down a rigid sequential path, hypertext documents provide users with a means to choose one of many different paths. Hypercards provide a useful access method to simple databases, and other hypermedia are also known.

Hypertext is a familiar term used to describe a particular form of organization and user presentation of information within a computer-implemented system and is a familiar element of the broader class of systems referred to herein as hypermedia. Hypermedia exploit the computer's ability to link together information from a wide variety of sources as a tool for exploring a particular topic. Such systems embrace large numbers of "data objects", which can be panels of text, titles, index entries or other data such as images, graphical tables, video or sound information, and so forth. The data object is said to reside at a "node" and may vary in size and type. A collection of such data objects is denominated a hypermedium. For data objects limited to text panels, that is, blocks of text data of varying size, the collection is referred to as a hypertext document.

Each data object is essentially self-contained but may contain references to other such objects or nodes. Such references are normally used in a hypertext document and are referred to as "links". A link is a user-activated control reference that causes the data object at the link target node to be displayed. Normally, hypertext systems are window-based and the newly displayed object appears in a new window. The new object or panel may, of course, contain additional links to other such panels. By following these links from panel to panel, the user "navigates" through and about the hypertext document. This scheme provides user-control over the order of information presentation and permits the user to select what is of interest and how to pursue a given topic.

Thus, a hypertext document essentially consists of a set of individual data objects or nodes interconnected by links. Each link is a relation between two nodes. The link relation includes data relating the location of the first panel where the link starts and the location of the second panel that is the target. Such location information may be stored in various forms, for example, it may be in the form of byte offsets indicating the number of bytes from the start of a file.

The set of link data for a given view of a hypermedium is known in the art as a link matrix and is denominated a link "profile" herein. Each such link profile contains a unique link vector or list for every node in the hypermedium. Each link vector is a list of the links between the corresponding "originating" node and other "target" nodes. The aggregate of such vectors, one for each node, makes up one link profile for the hypermedium.

In U.S. Pat. No. 4,982,344, Daniel S. Jordan discloses a data processing system that incorporates a method for accelerating the creation of such link vectors. Reference is made to Jordan's disclosure for a general understanding of object-oriented hypermedia systems. Reference is made to B. Shneiderman, *Hypertext: Hands On!*, Addison-Wesley Publ. Co., (1989), for a general background discussion of the hypertext concept. For a more introductory treatment, reference is made to J. Conklin, "Hypertext: An Introduction and Survey", *IEEE Computer*, Vol. 20, pp. 17–41, (1987).

Those familiar with the art are aware of the fundamental questions that still exist regarding how to direct the user to the information actually desired within a hypertext document. For example, consider the problem of writing a hypertext document for an unknown or potentially diverse audience. A link profile that might be useful for one type of user could be confusing to other users with different backgrounds or different objectives. Ideally, the hypertext document would adapt to different groups of users, providing different link profiles for different groups. But no effective adaptation methods were suggested in the art until now.

A related problem is the well-known trade-off between flexibility and complexity. In a hypertext document, the information (data object) at every panel node is associated with other panels throughout the document by means of a link profile containing many link vectors. The number of such associations from any given panel is potentially equal to the total number of such panels and, by allowing users to choose where to next jump, a greater number of link vectors provides more flexibility to an otherwise rigid process. However, as the number of link vectors grows, choosing where to next jump becomes a more complex problem for the user.

Compounding the problem of too many choices, are the other well-known hypertext issues such as becoming lost in hyperspace, not knowing what panel is targeted by a link before reaching it, and losing the organizational benefit of traditional sequential text. The Conklin reference cited above discusses these issues in detail. The negative effects of such problems can be avoided if the user is somehow guided to the correct link choices.

The existing art minimizes these problems by constraining the available choices in linking from one panel to another. This is done by providing only a few carefully chosen links to and from each panel. Thus, users are less likely to get lost or waste time exploring irrelevant nodes, but lack flexibility.

For example, it is possible that a user interested in a taco recipe may also be interested in trips to Mexico, food industry politics, the process of grinding corn by hand, and the Spanish Conquistadors. These and more topics can all be associated with tacos. Incorporating all such links in a hypertext document increases the system flexibility but also may confuse and frustrate the user.

One possible solution is to provide a great number of possible links, maximizing flexibility, while also discouraging certain links, effectively constraining the avail-

able choices. The user is then free to ignore system recommendation but may also follow them to minimize the risk of viewing irrelevant information. In the taco example, this could mean allowing the user to specify the slant or "task goal" desired in the review of tacos (e.g., the history of tacos, the market for tacos, taco recipes, etc.). However, nothing in the art suggests or teaches a suitable method for modifying a link profile in response to user-specified task objectives.

The typical hypertext link profile is predetermined according to the system designer's understanding of the typical user profile and is incorporated in the hypertext document with no provision for modification or weighted recommendation. The user model for a link profile is usually a simple matrix of ones and zeros relating each hypertext node or panel to all other such panels. Each link element is either zero (unlinked) or unity (linked), depending on the choices made by the author in view of the "connectedness" or relatedness between the panels.

Intelligent tutoring systems known in the art face a similar dynamic modification problem. Such systems must model not only the information to be taught to the user but also any mistakes likely to be made by the student user. Often, fairly complex rule-based expert systems are employed for this modelling. A wide range of sophisticated models are known in the art and reference is made to M. P. Anderson, et al., "Empirical User Modeling: Command Usage Analyses for Deriving Models of Users", *Proceedings of the Human Factor Society—31st Annual Meeting*, Vol. 31, pp. 41–45 (1987) for a discussion of the related art. Reference is also made to D. Carlson, et al., "HyperIntelligence: The Next Frontier", *Communications of the ACM*, Vol. 33, pp. 311–321 (1990). Reference is further made to R. Kass, et al., "The Role of User Models in Cooperative Interactive Systems", *International Journal of Intelligent Systems*, Vol. 4, pp. 81–112 (1989). Finally, reference is made to A. P. Norcio, et al., "Adaptive Human-Computer Interfaces: A Literature Survey and Perspective", *IEEE Transactions on Systems, Man, and Cybernetics*, Vol. 19, pp. 399–408 (1989). These references provide a general background of the user modelling and adaptive man-machine interface arts, which generally embrace models too complex for practical application to hypermedia systems.

Thus, there appears to be a need in the art for an adaptive user interface simple enough for effective use in hypermedia systems, permitting a hypertext document to be adapted to various users without losing the efficiency and flexibility associated with the hypertext technique. The related unresolved problems and deficiencies are keenly felt in the art and are solved by the present invention in the manner described below.

SUMMARY OF THE INVENTION

The present invention resolves the above problems by adding several new user-interface features to a combined hypermedia system, thereby obtaining unexpected and beneficial results. The first such feature is the incorporation of links between all nodes within a hypermedium. Existing hypertext documents provide from one to five links from an originating node to other target nodes, reflecting decisions of the document author as to how nodes should be interrelated.

The second feature of this invention avoids overwhelming the user with choices by introducing the concept of graduated link-weight values for ordering the linked nodes in a list so that the most relevant link targets appear first in a list presented to the user.

The third feature of this invention introduces a new type of link matrix, heretofore unknown in the art. The link matrix known in the art may be viewed as a set of vectors, each being a list of zero and unity link values relating each node to a few other nodes. The new type of link matrix of this invention is a set of link-weights relating the existing set of hypertext panel nodes to a new set of user goals. The set of user goals may also be considered as new hypertext nodes containing only a brief title and being linked to all other nodes. As with the panel-to-panel link matrix, every user goal is linked to all hypertext panel nodes. However, user goals need not be linked to one another, although they may be. A selected user goal and a selected panel are together denominated herein a user "context". Each such "context" corresponds to a unique set of link vectors.

As a fourth feature, to recommend target panels to a user, the method of this invention introduces a relative link-weight value representing the link between each panel node and all other panel nodes in the hypertext document. A relative link-weight value is also introduced to represent the strength of the relationship between the user goals and the various panel nodes in the document. The methods of this invention employ associative networks or matrices as a simple and highly effective means of representing these relationships. Associative matrices are simplified semantic networks, similar to the "neural networks" known for modelling relationships in information systems and human memory.

The present invention employs a first topic-to-topic (panel-to-panel) associative matrix and a second goal-to-topic associative matrix, and provides for the capability to combine linkage information from multiple matrices to arrive at a single set of recommendations in the form of a "user profile". Theoretically, other such associative matrices may be added to the system, but the two associative matrices disclosed herein have unexpectedly been found to provide adaptability sufficient for the objects of this invention.

A fifth feature of this invention introduces learning capability. A known practice is to interview a representative sample of system users to determine their collective linking preferences, incorporating such a fixed user profile in the hypertext document. This existing method can be used to determine initial link-weights for both the topic-to-topic matrix and the goal-to-topic matrix by attempting to anticipate the needs of the prospective users. This existing method alone does not permit dynamic adaptation of such associative matrices, however. The fifth feature of this invention is a self-adaptive or learning feature for dynamically updating these link-weight values in each associative matrix.

Two learning methods are introduced by this invention. The first is an inferential method for acquiring user information without any effort or attention from the user. The inferential method measures the time that a user views a particular "data object" or panel node and adjusts the linkage weight to that panel node accordingly. The linkage weight to that target panel may also be scaled to compensate for the length of time required to read the panel, which is proportional to the amount of text data in the panel.

The second learning method is active. The user can manually adjust a link-weight value to correct it in situations where a panel is held onscreen during a coffee

break without an attentive user or when a brief panel is deemed uninteresting. Thus, both automatic and manual methods for acquiring user profile information or characteristics are introduced in this invention. The hypermedia system of this invention incorporates both direct and inferential modes of learning.

Finally, a sixth feature of this invention is that many different "user profiles" may be accumulated and stored for later access by individual users having different interests. Moreover, the methods of this invention include unexpectedly simple and useful procedures for merging selected user profiles to form one or more general user-group profiles and for accumulating new user profiles over time to form a cumulative or adaptive system profile. These procedures are quite simple and their effect is wholly unexpected and beneficial.

The foregoing, together with other features and advantages of the present invention, will become more apparent when referring to the following specification, claims and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding the present invention, reference is now made to the following detailed discussion of the embodiments illustrated in the accompanying drawings, wherein:

FIG. 1 provides an illustrative topic-to-topic associative matrix;

FIG. 2 provides an illustrative goal-to-topic associative matrix;

FIG. 3 illustrates the connectionist network used in an illustrative embodiment of this invention;

FIG. 4 provides an illustrative embodiment of the HYPERFLEX interface of this invention;

FIG. 5 shows an illustrative embodiment of the hardware system of this invention;

FIG. 6 shows an illustrative embodiment of the computer system modules of this invention;

FIG. 7 provides a procedural diagram illustrating the functional steps of the HYPERFLEX embodiment of this invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The Goal-To-Topic Associative Matrix:

This invention combines several different simple associative connection networks with a hypermedia system in a new manner, to permit the dynamic modelling of hypermedia user profiles. These user profiles are collections of link-weight vectors or link-weight matrices used to select links to priority nodes by examining the rank ordering of the lists (vectors) of potential links. The ordering of a recommendation list depends upon the user profile, which consists of two associative matrices of link-weights that relate topics to topics and goals to topics. The user can actively teach the system by rearranging the order of suggested node links.

FIG. 1 shows an associative matrix 10 that captures the relationship between any topic in a hypertext system to any other topic. The link-weights, exemplified by link-weight 12, can be established by the hypertext document designer as fixed values to accomplish some objective. For example, the illustrative link-weights shown for matrix 10 in FIG. 1 indicate that vegetarianism is more strongly associated to nutrition than it is to surfing. A hypertext system can use the information in matrix 10 to suggest that a user currently reading about vegetarianism should next consider nodes related to nutrition rather than nodes related to surfing or steel working.

But suppose the reader is interested in California lifestyles. Then it would be appropriate for the system to recommend linkage from vegetarian to surfing, for that particular user. To capture this additional user knowledge, the method of this invention introduces another type of associative matrix that relates any topic in a hypertext system to any one of several user goals. This second associative matrix 14 is shown in FIG. 2.

FIG. 3 shows a hypertext connectionist network illustrative of that used by the inventors in a simulation experiment for the system of this invention. Note that each node, exemplified by node 16, is joined to all other nodes by links, exemplified by link 18. Hypermedia in general consist of nodes or panels (cards, topics, etc.) of information that are connected to one another by links. Hypermedia systems permit the user to jump, or link, from the current node to any other connected node. The method of this invention provides links between each node to all other nodes and also provides graduated link-weight values for each link to prioritize the other nodes, thereby preventing the unlimited options from overwhelming the user. The ordering of the link-weight vector values for a-single node reflects knowledge of both the user's current goals or context and the user's past choices.

In the example shown in FIG. 1, the number of link-weights in matrix 10 is less than the square of the number of topics in the hypertext document as a result of an assumed redundancy of the linkages represented by X in FIG. 1. If desired, the link-weight between surfing and nutrition may be valued differently from that between nutrition and surfing. That is, the linkages between topics may reflect the direction of topic transition.

Matrix 14 in FIG. 2 represents the association between specified user interests or goals and the topics in the hypertext system. Using the illustrative link-weights shown for matrix 14, the system of this invention would recommend both surfing and vegetarianism to a user interested in California lifestyles. Theoretically, as many such associative matrices as desired may be added to the system of this invention. There are many prospectively useful schemes for combining the information from such associative matrices to arrive at a single set of recommendations. A simple method preferred for this invention is described hereinbelow.

Thus, the methods of this invention use simple associative matrices to establish a user profile containing the link-weight values relating each topic in the hypertext system to all other topics in the same document.

System Learning Techniques:

The second discovery leading to this invention is the addition of simple neural network learning techniques to this associative matrix model. These learning techniques for dynamically modifying the hypertext user profile permit the system to link from each topic to all other topics without overwhelming the user with too many choices. Constraining the user model to the two associative matrices described above does not alone restrict how the link-weights are evaluated. The standard practice in the art for evaluating hypertext linkages is to perform knowledge engineering.

For example, a representative sample of system users is interviewed and their collective linking preferences established. In this invention, common user goals could be thus defined and incorporated into matrix 14, which relates goals to topics. Practitioners in the hypertext

system art use such an approach in establishing which links to exclude from the system. Such practitioners must attempt to anticipate the needs of their respective users and are obliged to compromise when such needs are self-conflicting. A knowledge engineering approach works well in determining an initial set of link-weights for matrices **10** and **12** but does nothing to suggest useful learning techniques.

One reason that simple link matrix models are preferred for this invention is that each link-weight value can be easily and dynamically updated to implement a self-adaptive or learning system. Reference is made to P. R. Innocent, "Towards Self-Adaptive Interface Systems", *International Journal of Man-Machine Studies*, Vol. 16, pp. 287–299 (1982) for the background of the self-adaptive system apt.

Consider, for example, if a company,s annual report is put on-line in a hypertext system, a financial analyst would want to proceed directly to the financial statistics and would also be interested in any other scattered information affecting the company's bottom line. An environmental group reading the same report would be interested in all references to environmental measures, wherever they may be. The author of the initial hypertext annual report cannot reasonably anticipate all of the various ways in which different audiences may wish to view the information. The method of this invention includes simple associative matrix combining procedures to "learn" new sets of recommendations for these different users.

Simple models have tremendous advantages in a learning environment. Not only is it easy to update knowledge represented as a matrix of numbers, but it is also easy to merge such knowledge using simple mathematical operations such as simple arithmetic averaging of the preferences of a set of users. Individual user profiles are easy to create and could be shared over a networked system, facilitating transfer of such information. With a learning system, each user becomes a source of expertise for the system and, with an ability to pool from many sources of expertise, it becomes possible to create a reservoir of experience and knowledge that is not practically available from traditional knowledge engineering methods.

The first learning method of this invention is an inferential method where the system learns by observing the behavior of the user and making inferences in accordance with these observations. For a general discussion of adaptive learning techniques, reference is made to D. Browne, et al. (Eds.), *Adaptive User Interfaces*, Harcourt Brace Jovanovich, London (1990). The second learning method of this invention is the direct teaching method, where the user forces changes to the link-weight values in matrices **10** and **14** by direct revision of topic priorities from the keyboard.

The inferential approach has the advantage that the user need not act to cause the system to learn, but also introduces the related risk of incorporating false inferences about user behavior. The direct teaching approach obliges the user to provide explicit feedback, adding a teaching task to whatever other user tasks exist, but the system will tend to learn correctly during the first iteration. The methods of this invention incorporate both direct and inferential modes of learning to accommodate requirements for accuracy and minimal user activity. The preferred embodiment of these methods is implemented as part of the HYPERFLEX embodiment discussed hereinafter.

The connectionist network (FIG. 3) model leads to an unexpectedly and advantageously elegant inferential learning technique based on simple associative matrix (neural) principles. The inferential learning method of this invention differs from the typical approach in the art, which uses an algorithm (such as back-propagation) to train the network. Such conventional training can require many thousands of cycles during which samples from a "training set" are presented and feedback is given to the system. When such a "neural" model has learned a training set, it is then usually treated as a black box or an expert system expected to generalize to new situations that may-be similar to the training set examples. Reference is made to J. L. McClelland, et al., *Parallel Distributed Processing: Explorations in the Microstructure of Cognition*, Vol. 2; *Psychological and Biological Models*, MIT Press, Cambridge (1986), for discussions of this learning and training approach.

Early System Learning Experiments:

The inventors performed experiments with an early, non-learning, version of the system of this invention. These experiments demonstrated the power of using recommendations based on goals in the manner disclosed above in connection with FIG. 2. Users were, on average, 36% faster in locating answers to questions when they used goal-based recommendations typified by goal-topic matrix **14** in FIG. 2, compared with a standard version typified by topic-topic matrix **10** in FIG. 1. Users also searched 28% fewer panels and were 10% more accurate when using the goal-based recommendations.

The inventors also conducted later experiments with early learning versions of this invention to determine the effectiveness of inferential learning methods for adapting to users as they use the system. Eighteen (18) users participated in the study. Results showed that once the system of this invention is trained by a single user, all subsequent users are able to locate information 24% faster than users of the same untrained system. Adding the learning from an additional two users provided only an additional 4% improvement in access speed.

Results demonstrate that the addition of goal-topic matrix **14** in FIG. 2 containing a set of goals for even a single user provides dramatic (24%) improvement of hypertext system efficiency. As soon as any user provides some goals and teaches the system to associate these goals with the panels of information, subsequent teaching merely serves to refine the associations without significant dramatic increases in system efficiency. Presumably, retraining by a single user from another "goal-group" will suffice to prepare the hypertext document for others in the new "goal-group".

The experiments are designed according to a learning objective that is to predict the most useful panel or panels to be targeted from a particular current panel and/or user goal. Thus, "input" to the connectionist (neural) system consists of a panel node and a goal node, and the "output" consists of an ordered list of all other panel nodes in the system. The "target" is the actual panel desired by the user. "Errors" represent non-target panels that are ranked higher in priority than the actual target panel node. The error measure is designed to compare the performance of the method of this invention with the methods of earlier static hypertext systems.

Table 1 shows an early embodiment of the learning rule of this invention and compares the performance of different activation rules for a typical training set.

TABLE 1

Learning Rule:

Weights are changed on each cycle according to the following rule:

$\delta W(c,t) =$ 1.0 if t is target and c is currently active panel (previous target)
$\delta W(c,t) =$ 0.5 if t is target and c is current goal
$\delta W(i,j) =$ 0 otherwise

Activation Rule:

A(i) =	Error after one Epoch	Lowest Error Achieved	#Epochs to Lowest Error
1. $A(c)W(c,i)/\Sigma_j W(c,j) + A(g)W(g,i)/\Sigma_j W(g,j)$	.10	.06	4
1a. $1/(1 + \exp(-A(i)))$ {previous with sigmoid}	.47	.17	3
2. $A(c)W(c,i)/\Sigma_j W(c,j) + A(g)W(g,i)\Sigma_j W(g,j) + A(i)*D$ {D=.75}	.37	.34	5
2a. $1/(1 + \exp(-A(i)))$ {previous with sigmoid}	.47	.08	7
3. $\Sigma_n(A(n)W(n,i)/\Sigma_j W(n,j)) + A(i)*D$ For all n element of {panel, goals}	.93	.45	6
3a. $1/(1 + \exp(-A(i)))$ {previous with sigmoid}	.50	.32	6

With an unordered list, users must search an average of N/2 panels (N=total number of panel nodes) to find a target. The error measure is P/(N/2), where P is the number of panels ranking higher than the target panel. This reflects the normalized time required to search the ordered list for the target panel. Thus, errors less than unity represent a net gain in efficiency over existing art for users of the method of this invention.

The system of this invention requires functions or rules that will allow it to properly capture and use the link-weight associations between panels. The "best" rule depends on the types of relationships existing between the panel nodes. The rules in Table 1 are known to be useful in the art for modelling human memory functions and were considered by the inventors during the development of this invention. The weights change on each cycle according to the very simple learning rule in which the link-weight between two nodes, W(A,B), begins at unity and increases by one each time that B is the target and A is the input (or by 0.5 if A is the current goal node). Essentially, this rule assumes that the more a link was used in the past, the more likely it is to be useful now. The error numbers in Table 1 are based on the assumption that the lowest error point exists when the error measure decreases less than 0.001 over successive epochs. The training set used to generate Table 1 includes four sequences of seven items each in a twenty-item connectional network.

In this invention, the activation of a node represents the likelihood that it would be relevant to the user's current situation. Activation is spread from node A to node B proportionately to link-weight W(A,B). Six different activation functions were experimentally evaluated by the inventors with the results shown in Table 1. In all cases, the activations of the current node c (representing the panel currently viewed by the user) and the current user goal g are initially set to unity.

In the simplest activation rule, Rule 1, the activation of node i, A(i), is a function of the two link-weights between A(i) and the current node c as well as the goal node g. In particular, because activation of c and g are unity by definition, the activation of i is proportional to the link-weight between c and i, W(c,i), divided by the sum of the link-weights from c to all other nodes, $\Sigma_j W(c,j)$, plus a similar term representing the sum of all link-weights from g. With Rule 1, the strength of the connections from the current node and goal determine the activations of all other nodes.

The second activation function in Table 1, Rule 2, permits each node to carry over some of its previous activation on each new cycle. The third activation function, Rule 3, spreads activation from each node on each cycle. This third rule permits groups of nodes to "reinforce" each other. Finally, each of the above three rules is recast in terms of a sigmoid or "squashing" function (Rules 1a, 2a and 3a), which forces the node activation value to remain between zero and 1.

The inventors measured the performance of these six activation rules for a twenty-node network using randomly selected training sequences. The training set included four such random sequences and each sequence started with a goal followed by seven nodes or panels. The network was trained using each node in the series as first the target and then the input for the next target. In each epoch, the network was trained once with each of the sequences and the average error was measured.

The unexpected and useful result of this experimentation by the inventors is the evidence in Table 1 that the simplest activation rule provides the best overall results. With Rule 1, the network learned quickly, reducing the error to 0.1 after the first pass through a training set. It achieved the lowest error overall (0.06) after only four epochs. This error rate suggests that the theoretical user of the adaptive interface represented by Rule 1 would spend as little as 6% of the search time that would be required by a user of an identical non-adaptive system.

The particular panel-to-panel transitions are the most important relationships for the training set. The network is essentially learning transition probabilities using the user goal node weights as a biasing term. There may be other environments that would favor another of the activation functions in Table 1, such as situations in which second order effects are important. For example, a second order effect is represented where panel D is relevant only after reading both panels B and C.

The learning difficulty of a sequence can be roughly determined in terms of its branching factor, which is the number of nodes branching from each source node. The branching factor is indirectly influenced by the number of nodes in the network, the number of distinct sequences and the number of nodes per sequence. The inventors have conducted simulated experiments in which these parameters were varied and have unexpectedly discovered that excellent learning almost always occurs during the first epoch. Such excellent learning is defined as 70% to 90% reduction in the error measure. Moreover, as network capacity is increased by increasing the branching factor, the error measure was found to increase only gradually and predictably. Accordingly, the inventors developed a new, simpler "rank-ordering" learning rule discussed hereinafter, which is the preferred learning rule for the method of this invention.

These unexpected results and discoveries suggest that the adaptive system of this invention is useful with either a new user or the user by whom the system was

trained for the same task. This invention is also useful for the same user involved in new tasks. However, a new task for a new user will not be simplified by using the method of this invention because no system learning has occurred relative to either the task or the user.

The preferred embodiment of this invention incorporates a simple "rank-ordering" inferential learning method that is an automatic learning technique that creates associations between a user goal or link panel selected by the user and any subsequent panels visited by the user. The strength of these associations is increased in direct proportion to the amount of time the user spends viewing each panel. Because some panels contain more text than others, a normalized measure of time per line of text is preferred. This preferred method provides link-weight values for ranking the target panels in order and is better understood with reference to FIGS. 7–8 and the following discussion.

Operation of the Preferred Embodiment:

The following discussion relates to the flow chart provided in FIG. 7 and to an illustrative user interface screen shown in FIG. 4 for the preferred embodiment of this invention, herein denominated the HYPERFLEX system. The procedural flow of the HYPERFLEX embodiment is presented in FIG. 7. An illustration of the Autolearn function of this invention is included in FIG. 7.

The inventors developed the HYPERFLEX prototype of this invention as a smart hypertext system that learns. HYPERFLEX combined elements from an existing IBM hypertext product known as the Information Presentation Facility (IPF) (reference is made to the Information Presentation Facility section of the *OS/2 Version* 1.2 *Programming Guide*, IBM Corp. (1989)) with a special software implementation of an intelligent advisory system developed using Digitalk's SMALLTALK programming language (reference is made to *SMALLTALK/VPM Object-Oriented Programming System*, Digitalk, Inc., Los Angeles, Calif. (1989)).

HYPERFLEX allows authors to create documents containing "panels" of information having arbitrary length. These panels can contain text or graphics. HYPERFLEX is maximally flexible in that users may link from any panel to any other panel in a document. FIG. 5 provides an illustration of the hardware elements suitable for implementing the HYPERFLEX embodiment of this invention. FIG. 6 provides an alternative illustration of the computer system elements embraced by the HYPERFLEX embodiment.

FIG. 4 shows an illustrative user interface for HYPERFLEX. The large window 20 displays the "current panel" viewed by the user. Users can jump to any other panel in the document by selecting the title of another panel from the Recommendations window 22. The panel titles may consist of any desired identifier extracted from the data object at the node representing the desired text panel typified by panel title 24 ("1. Linked Panel"). The user establishes a "context" by first selecting a topic and/or goal before HYPERFLEX can make any recommendations. This "context" can also be determined by any suitable default scheme.

HYPERFLEX is a "smart" hypertext system because recommended panels are listed in rank order at the top of Recommendations window 22. For example, the four items listed above the threshold line 26 are titles of panels recommended by the system. The user is free to ignore these recommendations and the lower part of Recommendations window 22 may be scrolled upward to reveal a list of every panel in the document, most of which are not sufficiently related to the panel displayed in large window 20 to be selected as recommendations. The user may "teach" the system by moving any of these panels to a new list position by "clicking and dragging" with a mouse input device in a fashion commonly known in the computer art.

Referring to FIG. 7 for a summary of the HYPERFLEX procedure, note that HYPERFLEX recommends panels to the user according to both the relationship with either a selected panel, the goals of the user, or both; that is, according to a "context". These factors can be considered by way of the small windows and menus appearing above Recommendations window 22 in FIG. 4.

The Goals window 28 lists goals or tasks associated with a document. In FIG. 4, the selected goal 30 appears in reverse video. The top four panels listed in Recommendations window 22 are those panels that HYPERFLEX finds to be associated with learning more about selected goal 30. Moreover, the four listed panels are ranked according to the strength of the associations with selected goal 30. Such information concerning association strength is stored in a simple goal-to-panel profile such as matrix 14 in FIG. 2.

The recommendations in Recommendations window 22 can be based solely on selected goal 30, or a user may also request that such recommendations relate instead to the contents of a particular panel of interest. By selecting any panel title in Recommendations window 22 and then selecting the Linked Panel window 32, the user causes the selected panel title (not shown) to appear in Linked Panel window 32. HYPERFLEX then limits its recommendations to those based on the strength of association between the "linked panel" and other panels in the system.

For example, if the panel title "adding a goal" is selected and made a linked panel, HYPERFLEX recommends other panels that are related to "adding a goal" and ranks them at the top of Recommendations window 22 in numerical order. These HYPERFLEX recommendations are based on a simple panel-to-panel profile such as matrix 10 in FIG. 1.

For recommendations based both on selected goal 30 and a linked panel listing in Linked Panel window 32, the user merely selects both a goal and a linked panel. In such case, the recommendations in Recommendations window 22 are listed in numerical rank according to the union of the sets of recommendations that would have appeared for either goal or linked panel alone. The recommendation ranking will place panels strongly associated to both at the top and others lower in the list according to the simple matrix merging procedure disclosed hereinafter.

The user can also educate the system about new goals and teach new associations between existing goals and panels. Selecting or adding a goal is one way to change the "context". To add a new goal to his user profile, the user selects the goals function in Command Menu window 34 (FIG. 4) and then types in whatever goal is desired. HYPERFLEX treats this new information as a "node" in the hypertext document with the special property of being a "goal node". A new link vector consisting of a row of link-weight values for the new goal is added to the goal-panel link matrix (matrix 14 in FIG. 2). The link-weight values contained in the new link vector are thereafter modified when HYPERFLEX begins creating associations between the new

goal and panels as the user interacts with the system either through direct manipulation by the user or through the Autolearn mode with the new goal selected.

HYPERFLEX user profiles are implemented with associative matrices not unlike those used in neural networks, each element being a link-weight value. Because each panel is linked to all other panels in the document as well as to data object nodes representing specific task goals created by the user, updating a user profile involves updating the two distinct link matrices typified in FIGS. 1 and 2. When a user selects goal 30 in Goal window 28 (FIG. 4), the HYPERFLEX recommendations in Recommendations window 22 are developed by using only the matrix relating panels to goals (matrix 14 in FIG. 2). When the user selects a link panel in Linked Panel window 32, and does not select goal 30, HYPERFLEX develops recommendations using only the matrix relating panels to panels (matrix 10 in FIG. 1). When the rankings of recommendations in Recommendations window 22 are directly changed by the user, HYPERFLEX updates both matrices individually, according to the necessary changes in link-weight values.

If the user selects both a goal and a panel, HYPERFLEX merely adds the two appropriate link vectors from both matrices 10 and 14 and sorts the link-weight values in the sum vector. When a user, by direct manipulation ("click and drag" with a mouse), moves a panel in the ordered list with both the current panel and the task goals specified, no information is available to correctly attribute the change proportionately between the two corresponding link vectors from matrices 10 and 14. The HYPERFLEX embodiment assumes an equal share between the two vectors. It calculates the change in the sum rank needed in order for the panel to be moved to the desired place in the ordered list and updates each of the two ranking link-weight values in equal proportions. Where a panel is currently ranked in either of the two link vectors at the top or bottom of the list and cannot be further adjusted, the surplus change effect is transferred to the other link vector.

Referring to the illustrative system embodiment of FIG. 6, note that the "Context" definer 36, the profile processor 38, the Autolearner 40 and the keyboard input handler 42 may be considered together as an advisor module 44. Advisor module 44 embraces the functions discussed in detail above in connection with FIG. 4 and is disposed to interact with the hypertext system 46 in association with the Central Processor Unit (CPU) system 48. Hypertext system 46 includes means for storing the data objects making up the hypertext documents used by system. Context definer 36 includes the goals definition function and is responsive to both selected goal 30 (FIG. 4) and linked panels (not shown) within Linked Panel window 32. Profile processor 38 opens, modifies, updates, merges and saves the user profiles stored in a non-volatile profile store 50. Autolearner 40 includes provision for being turned on and off. Keyboard input handler 42 allows the user to "click and drag" any panel in Recommendations window 22 (FIG. 4) to any new priority position and also passes "double-clicks" through to hypertext system 46.

Advisor 44 is connected to hypertext system 46 and non-volatile profile store 50. The remainder of the system in FIG. 6 is substantially similar to the hardware system presented in FIG. 5 except that the mouse 52 is shown independent of keyboard 54, which is an alternative embodiment of the combined mouse/keyboard shown in FIG. 5.

In summary, the HYPERFLEX embodiment provides features permitting a user to jump from any panel to any other panel directly, or according to recommendations based on user goals, panels of known interest, or both panels of interest and user goals. Users may add new goals dynamically. Individual user profiles are maintained to capture the unique interests of individual users, and user profiles can be merged to create new group profiles. The Autolearn mode permits the system to observe user actions and learn by inference. The teaching mode allows the user to specify system behavior directly. Finally, both system behavior and learning features are based on very simple models of user requirements.

The HYPERFLEX Auto-Learn Command:

The HYPERFLEX embodiment acquires knowledge through a learning process and updates this knowledge over time. The user can select the Autolearn feature in Command Menu window 34 to activate the adaptive learning features of HYPERFLEX. When Autolearn is selected, HYPERFLEX begins immediately to create associations between selected goal 30 or a linked panel listing in Linked Panel window 32 and whatever subsequent panels are visited by the user through selection and display in large window 20. The strength of these associations is in direct proportion to the amount of time the user spends viewing each panel displayed in large window 20. Because some panels contain more text than others, a normalized measure of time per line of text is used rather than absolute time. FIG. 7 illustrates the procedural steps of the Autolearn function.

For example, if a user selects a goal of "learning about goals" in Goals window 28, the Autolearn function will automatically associate to this goal all subsequent panels selected by the user for viewing in large window 20. The goal-panel association matrix portion of the respective user profile will be modified by the system to increase the link-weight values relating to the "learning about goals" goal and the viewed panels. Moreover, the link-weight values will be higher for those panels that are longer viewed by the user. Those panels viewed longest by the user will eventually appear on HYPERFLEX's list of recommended panels in Recommendations window 22 whenever the goal "learning about goals" is again selected.

Autolearn has the advantage of being an automatic learning mode but also presents certain obvious difficulties. For instance, the user may select the wrong panel accidentally. The user may also be interrupted or take a coffee break during the viewing of a panel under the Autolearn option. In such cases, HYPERFLEX will erroneously conclude that the user has an insatiable curiosity about whatever panel happens to be on display when the user is interrupted.

The direct or teaching mode is included in the HYPERFLEX system to cope with such difficulties as well as to provide a more direct method of teaching HYPERFLEX quickly. With this feature, the user may at any time drag the panel titles from Recommendation window 22 to any position on the recommended list, either above or below threshold line 26. When the user changes the position of recommended panel titles, the HYPERFLEX system automatically updates the relevant associative matrices to reflect the new link-weight values.

For example, the user may select a goal of "learning about goals" and then drag "goals window", "customizing goals" and "adding a goal" from below to above threshold line 26. HYPERFLEX would then create new associations between the selected goals and these panels. The strength of these associations, as reflected in the link-weight values stored in the goal-panel matrix portion of the relevant user profile will reflect the list location to which the user chooses to drag each panel title.

HYPERFLEX can create new user profiles by merging existing profiles according to the merging procedures disclosed hereinafter. For example, a departmental profile can be created which reflects the weighted average associations of all department members together with all member goals. Such profiles may be loaded, merged or saved by selecting the profile menu option in the Command Menu window 34. After selecting the profile option, other windows and instructions appear to the user according to the profile merging methods of this invention described hereinafter.

User Profile Merging Procedures:

Information about the identity and preferences of a user is captured in a user profile. The HYPERFLEX system uses the user identity only in connection with distinguishing the user's set of goals and/or topic associations from those of another user. Thus, user profiles differ structurally from one another only in these respects. A particular hypertext document may have many different user profiles, each reflecting the associations of a different user and each leading to different recommendations.

Different user profiles for the same hypertext document may be merged by the methods of this invention to combine different users' knowledge and preferences. A user may select the profiles desired for combination and may also specify the relative weight of importance assigned to each of the profiles. HYPERFLEX computes a weighted average over the different profiles for each of the link vectors in the two topic and goal matrices 10 and 14. Each link vector is a list of link-weight values for all panels linked to the particular current panel or goal associated with the link vector.

An additional feature of this invention is necessary to avoid errors arising from the "missing panel" problem. As some hypertext systems may grow with time, different user profiles may contain different numbers of panels. That is, an older user profile A may contain link vectors that do not include link-weight values linking the associated panel to a number of the newer panels or goals that were added to the system since user A last signed on. Thus, corresponding link vectors in different profiles for the same current panel or task goal may have different maximal rank values as well as different vector lengths. To ensure meaningful comparison between user profiles, all link vectors are normalized to a standard scale before averaging. Also, to accommodate different vector lengths, the weighted average of the ranks of a target panel is computed across only those profiles that contain references to that panel and the result is adjusted by the total weights of such profiles. This can be understood from the following symbolic discussion.

Let R_{ijp} denote the normalized link-weight value (rank) of panel j given current panel i or task goal i in profile p. Let W_p denote the weight assigned to profile p. Let P denote the set of profiles that contains both panels i and j. According to the preferred HYPERFLEX embodiment of this invention, the weighted average of the normalized link-weight value (rank) is:

$$R_{ij}=R_{ijp}=\Sigma_p R_{ijp}*W_p/\Sigma_p W_p \text{ (for p in P)}$$

HYPERFLEX then sorts the computed weighted averages of all target panels. That is, it sorts across all j's for each current panel or goal i and reassigns ordered link-weight values to link vectors in the new combined profile.

The HYPERFLEX embodiment also provides for maintenance of an incrementally adaptive system default profile for a hypertext document. This system profile captures the knowledge and experience of active users by maintaining a moving average of the link vectors in recently invoked user profiles. The algorithms for merging new user profiles is based on a Most Recently Used (MRU) strategy.

The merge procedure is similar to that of the selective merge of user profiles just described, but the relative weights given to the current system profile and the new user profile to be merged into the current system profile are predetermined. HYPERFLEX maintains a constant, K, which is the inverse of the weight given to a new user profile to be added to the system profile. This constant K also reflects the size of the initial pool of user profiles needed to establish a reasonable moving average system profile. The system monitors the value of N, which is the number of updates (the number of times that some user profile was added to the system profile) already made to the incrementally adaptive system profile.

Let R denote the normalized link matrix of the system profile. Let R1 denote the normalized link matrix of a user profile to be added to the system profile. To build the initial system profile average, when $N<K$, the method of this invention is to update R according to the formula:

$$R=(R*N+R1)/(N+1)$$

After the initial system profile is established and $N<K$, the normalized link matrix is updated according to the formula:

$$R=(R*(K-1)+R1)/K$$

At any point in its history, the adaptive system profile R is a weighted average of the entire collection of user profiles added throughout its history. Older user profiles are down-weighted exponentially by a factor of $(K-1)/K$ each time a new one is added, and the total weights of all user profiles always add up to unity. Index subscripts for panels and goals were excluded from the two formulas but the same missing panel normalization scheme discussed above can be used to avoid errors resulting from missing panels.

HYPERFLEX maintains two versions of an adaptive system profile. A real-valued version of the normalized link profile is maintained for incremental updating to avoid significant round-off errors. The updated link profile is then sorted and converted into a standard rank order matrix after every update and the new system profile is then made available to users.

Clearly, other embodiments and modifications of this invention will occur readily to those of ordinary skill in the art in view of this teachings. Therefore, this invention is to be limited only by the following claims, which

include all such obvious embodiments and modifications when viewed in conjunction with the above specification and accompanying drawings.

We claim:

1. A computer-implemented hypertext system comprising:
- display means for displaying images and text;
- keyboard means for accepting user commands;
- memory means for storing a plurality of data objects including user goal objects and text panel objects organized to form at least one hypertext object;
- profile storage means for storing at least one link profile each associated with a specific set of one or more users and containing a plurality of link vectors each containing a plurality of numerical link-weights each representing an associated user activity relationship between two said data objects; and
- advisor means for creating an ordered list of one or more said data objects responsive to user input activity, said list being ordered in accordance with the relative values of said numerical link-weights representing said user input activity.

2. The system of claim 1 wherein said advisor means further comprises:
- context definer means for selecting a link vector from a user profile responsive to said user input activity.

3. The system of claim 2 wherein said advisor means further comprises:
- clock means for indicating elapsed time; and
- autolearner means for updating a user profile responsive to the data object selection activity and said elapsed time associated with said user input activity.

4. The system of claim 3 wherein said advisor means further comprises:
- profile processor means for combining a first plurality of said link profiles to form one or more new link profiles each associated with a combined set of users including users associated with link profiles from said first link profile plurality.

5. The system of claim 1 wherein said advisor means further comprises:
- clock means for indicating elapsed time; and
- autolearner means, within said advisor means for updating a user profile responsive to the data object selection and viewing time associated with said user input activity.

6. The system of claim 1 wherein said advisor means further comprises:
- profile processor means for combining a first plurality of said link profiles to form one or more new link profiles each associated with a combined set of users including users associated with link profiles from said first link profile plurality.

7. A method for operating a computer-implemented object-oriented hypertext system having a plurality of link profiles each associated with a specific set of one or more users and containing a plurality of link vectors each containing a plurality of numerical link-weights, each said link-weight representing an associated user activity relationship between one of a plurality of data objects and another one of said plurality of data objects, said plurality of data objects including text panel objects and user goal objects, said system also having display means for displaying images and text, keyboard means for accepting user commands, and at least one memory means for storing said data objects and link profiles, said method comprising the steps of:
- (a) selecting a first link profile having a first link vector corresponding to a first data object, wherein said first data object is either a text panel object or a user goal object;
- (b) displaying at least part of said first data object on said display means responsive to said keyboard means;
- (c) comparing the link-weights within said first link vector to find a maximum link-weight value; and
- (d) displaying on said display means at least part of a second data object corresponding to said maximum-valued link-weight, wherein said second data object is a text panel object.

8. The method of claim 7 further comprising the steps of:
- (e) sorting into numerical order said link-weights in said first link vector; and
- (f) displaying at least one identifier from each of one or more said data objects and the associated link-weight ordering for each said identifier displayed.

9. The method of claim 8 wherein said displaying step (f) further the comprises the step of:
- (f.1) displaying said one or more displayed identifiers in order of the value of said associated link-weight.

10. The method of claim 9 further comprising the steps of:
- (g) comparing said associated link-weight values in said first link vector with a threshold value; and
- (h) displaying said identifiers for data objects associated with link-weight values greater than said threshold value.

11. The method of claim 8 further comprising the step of:
- (g) changing the link-weight value associated with a selected data object responsive to user input activity at said keyboard means, whereby the sort order of said displayed identifiers is changed responsive to said user input activity.

12. The method of claim 7 wherein said selecting step (a) further comprises the steps of:
- (a.1) merging a first plurality of said link profiles to form a combined link profile associated with a combined set of users including each user associated with a link profile from said first link profile plurality; and
- (a.2) selecting said combined link profile to be said first link profile.

13. The method of claim 12 wherein said merging step (a.1) further comprises the steps of:
- (a.1.1) calculating the link-weight values for a system link profile R by merging the link-weight values of a new link profile R_n with the corresponding link-weight values of an existing system link profile R_e according to the formula, $R=(R_e*(K-1)+R_n)/K$, where K is a predetermined constant; and
- (a.1.2) storing said link-weight values for said system link profile R in said memory means.

14. The method of claim 13 wherein said calculating step (a.1.1) further comprises the step of:
- (a.1.1.1) initializing said link-weight values in said system link profile R by merging a new link profile R_n to an existing system link profile Re according to the formula, $R=(R_e*N+R_n)/(N+1)$, where $N<K$ and N is the number of profiles that have been previously merged to form said existing system link profile R_e.

15. The method of claim 12 wherein said merging step (a.1) further comprises the steps of:

(a.1.1) calculating, for each link between data objects j and i, a normalized link-weight value R_{ij} representing the corresponding link-weight value for the merger of a set of link profiles, by first assigning a profile weight W_p to the p^{th} said link profile in a subset (ij) of said set and then averaging said subset (ij) according to the formula $R_{ij}=\Sigma_p(R_{ijp}*W_p)\Sigma_pW_p$, where said subset (ij) excludes all said link profiles in said set that do not contain a link-weight value relating data objects j and i; and

(a.1.2) storing said normalized link-weight values R_{ij} in said combined link profile in said memory means.

16. The method of claim 1 further comprising the steps of:

(e) modifying said first link profile responsive to user activity at said keyboard means; and

(f) storing said modified first link profile in said memory means.

17. A method for operating a computer-implemented object-oriented hypertext system having a plurality of link profiles each associated with a specific set of one or more users and containing a plurality of link vectors each containing a plurality of numerical link-weights, each said link-weight representing an associated user activity relationship between one of a plurality of data objects and another one of said plurality of data objects, said plurality of data objects including text panel objects and user goal objects, said system also having display means for displaying images and text, keyboard means for accepting user commands, clock means for indicating elapsed time, and at least one memory means for storing said data objects and link profiles, said method comprising the steps of:

(a) selecting a first link profile having a first link vector corresponding to a first data object and a second link vector corresponding to a second data object, wherein said first data object is either a text panel object or a user goal object and said second data object is a text panel object;

(b) displaying at least part of said first data object on said display means;

(c) displaying at least part of said second data object on said display means responsive to user activity at said keyboard means;

(d) recording a start time from said clock means to begin measurement of an elapsed time interval;

(e) monitoring for a predetermined event signaling that said elapsed time interval should end;

(f) recording a stop time from said clock means to complete said measurement of said elapsed time interval;

(g) computing a view time for said second data object by subtracting said start time from said stop time;

(h) calculating a new link-weight value representing said associated user activity relationship between said first data object and said second data object, said new link-weight value being at least partly proportional to said view time; and

(i) storing said new link-weight value in said first link profile in said memory means.

18. The method of claim 17 further comprising the steps of:

(j) comparing the link-weights within said second link vector to find a maximum link-weight value; and

(k) displaying at least part of a third data object corresponding to said maximum-valued link-weight, wherein said third data object is a text panel object.

19. The method of claim 18 further comprising the steps of:

(l) sorting into numerical order said link-weights in said second link vector; and

(m) displaying an identifier for each of one or more corresponding said text panel objects, said identifier including the associated link-weight ordering for said each corresponding text panel object.

20. The method of claim 19 wherein said displaying step (m) further comprises the step of:

(m,1) displaying said identifiers in order of the value of said associated link-weight.

21. The method of claim 20 further comprising the steps of:

(n) comparing said associated link-weight values in said second link vector with a threshold value; and

(o) displaying only said identifiers for said corresponding text panel objects associated with link-weight values greater than said threshold value.

22. The method of claim 19 further comprising the steps of:

(n) modifying said first link profile responsive to user activity at said keyboard means; and

(o) storing said modified first link profile in said memory means.

23. The method of claim 17 wherein said selecting step (a) further comprises the steps of:

(a.1) merging a first plurality of said link profiles to form a combined link profile associated with a combined set of users including each user associated with a link profile from said first link profile plurality; and

(a.2) selecting said combined link profile to be said first link profile.

24. The method of claim 23 wherein said merging step (a.1) further comprises the steps of:

(a.1.1) calculating the link-weight values for a system link profile R by merging the link-weight values of a new link profile R_n with the corresponding link-weight values of an existing system link profile R_e according to the formula, $R=(R_e*(K-1)+R_n)/K$, where K is a predetermined constant; and

(a.1.2) storing said link-weight values for said system link profile R in said memory means.

25. The method of claim 24 wherein said calculating step (a.1.1) further comprises the step of:

(a.1.1.1) initializing said link-weight values in said system link profile R by merging a new link profile R_n to an existing system link profile R_e according to the formula, $R=(R_e*N+R_n)/(N+1)$, where $N<K$ and N is the number of profiles that have been previously merged to form said existing system link profile R_e.

26. The method of claim 23 wherein said merging step (a.1) further comprises the steps of:

(a.1.1) calculating, for each link between said first and second data objects j and i, a normalized link-weight value R_{ij} representing the corresponding link-weight value for the merger of a set of link profiles, by first assigning a profile weight W_p to the p^{th} said link profile in a subset (ij) of said set and then averaging said subset (ij) according to the formula, $R_{ij}=\Sigma_p(R_{ijp}*W_p)/\Sigma_pW_p$, where said subset (ij) excludes all said link profiles in said set that do not contain a link-weight value relating said first and second data objects j and i; and

(a.1.2) storing said normalized link-weight values R_{ij} in said combined link profile in said memory means.

27. The method of claim **17** wherein said monitoring step (e) further comprises the step of:

(e.1) monitoring for an input signal from said keyboard means representing user activity.

28. The method of claim **17** wherein said calculating step (h) further comprises the step of:

(h.1) recalculating said new link-weight value to be at least partly inversely proportional to the quantity of data contained in said second data object.

29. A combination for use with a computer-implemented hypertext system, said combination including display means for displaying images and text and a program medium for storing program and data objects and structures comprising:

a program object structure stored in said program medium, said program object structure including a plurality of program objects including:

a program object for controlling said hypertext system including a plurality of link profiles each associated with a specific set of one or more users, each said link profile containing a plurality of link vectors each containing a plurality of numerical link-weights, each said link-weight representing an associated user activity relationship between one of a first plurality of said data objects and another one of said first plurality of data objects, said first plurality of data objects including text panel objects and user goal objects;

a display program object for controlling the display of images and text on said display means;

a program object for controlling a clock means for indicating elapsed time;

a program object for controlling a selection of a first link profile having a first link vector corresponding to a first data object and a second link vector corresponding to a second data object, wherein said first data object is either a text panel object or a user goal object and said second data object is a text panel object; and

a plurality of said program objects including an object for displaying at least part of said first data object on said display means, an object for displaying at least part of said second data object on said display means responsive to user activity at said keyboard means, an object for recording a start time from said clock means to begin measurement of an elapsed time interval, an object for monitoring for a predetermined event signaling that said elapsed time interval should end, an object for recording a stop time from said clock means to complete said measurement of said elapsed time interval, an object for computing a view time for said second data object by subtracting said start time from said stop time, an object for calculating a new link-weight value representing said associated user activity relationship between said first data object and said second data object, wherein said new link-weight value is at least partly proportional to said view time, and an object for controlling the storing of said new link-weight value in said first link profile data object.

* * * * *

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United States Patent [19]

Gerace

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[45] Date of Patent: Dec. 8, 1998

[54] **METHOD AND APPARATUS FOR DETERMINING BEHAVIORAL PROFILE OF A COMPUTER USER**

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[73] Assignee: **Freedom of Information, Inc.**, Cambridge, Mass.

[21] Appl. No.: **634,900**

[22] Filed: **Apr. 26, 1996**

[51] **Int. Cl.**[6] **G06F 19/00**

[52] **U.S. Cl.** **705/10**; 705/1; 705/10; 455/6.2

[58] **Field of Search** 386/1; 348/1, 2; 455/2, 6.2; 434/236; 705/1, 10

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Assistant Examiner—M. Irshadullah
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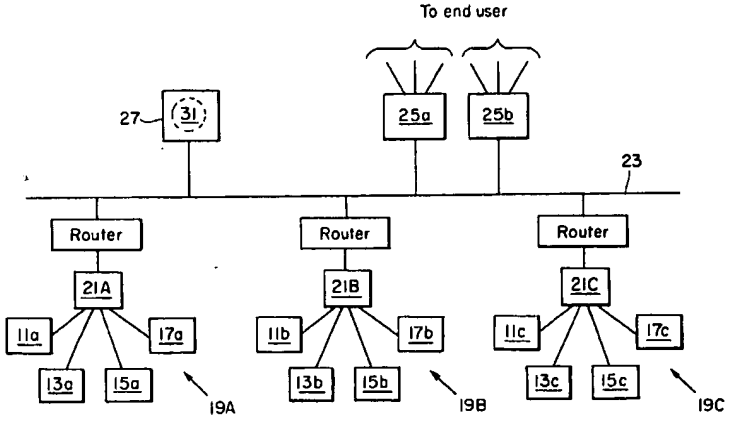
[57] **ABSTRACT**

Computer network method and apparatus provides targeting of appropriate audience based on psychographic or behavioral profiles of end users. The psychographic profile is formed by recording computer activity and viewing habits of the end user. Content of categories of interest and display format in each category are revealed by the psychographic profile, based on user viewing of agate information. Using the profile (with or without additional user demographics), advertisements are displayed to appropriately selected users. Based on regression analysis of recorded responses of a first set of users viewing the advertisements, the target user profile is refined. Viewing by and regression analysis of recorded responses of subsequent sets of users continually auto-targets and customizes ads for the optimal end user audience.

28 Claims, 10 Drawing Sheets



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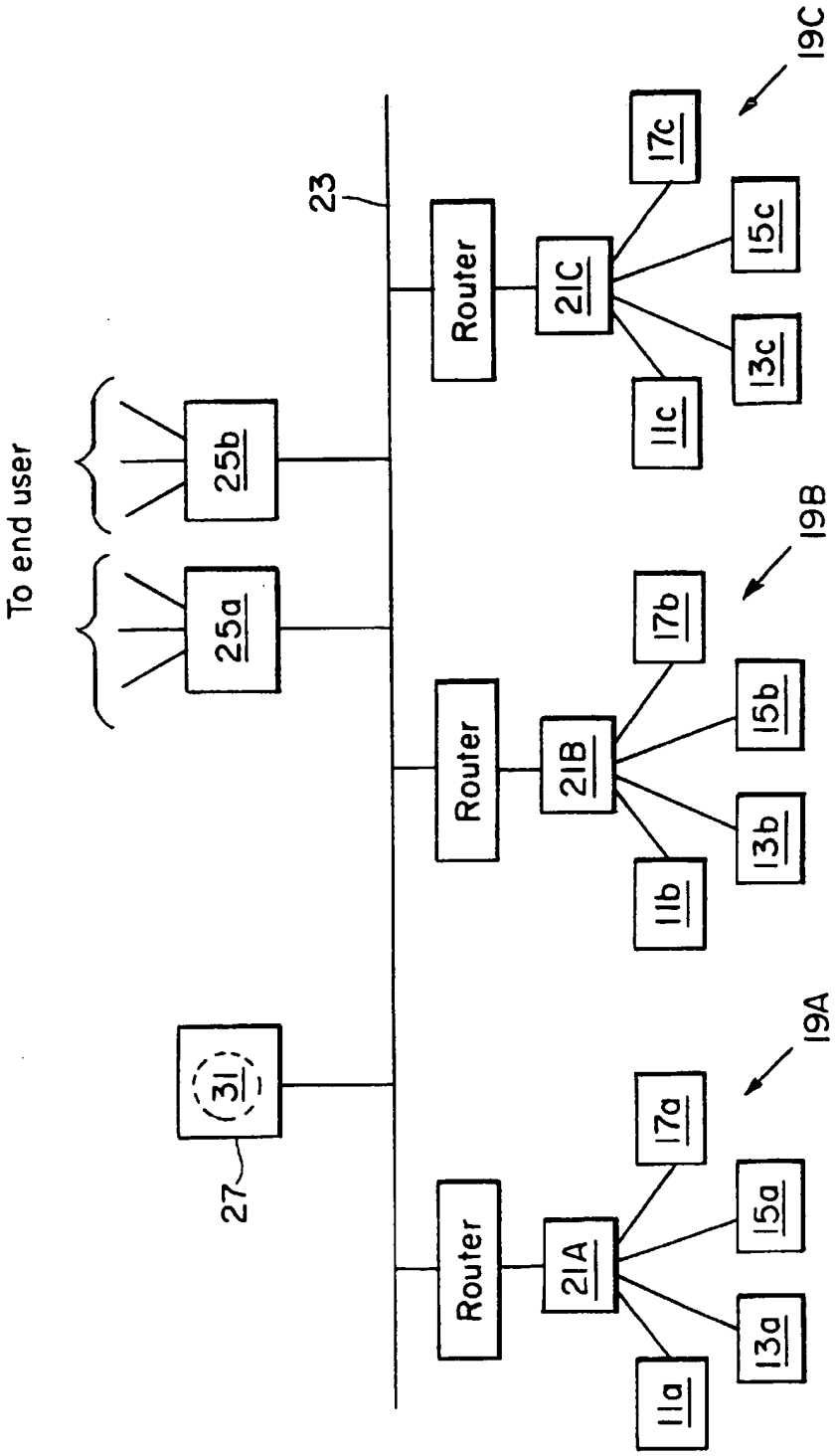

19C
17c
15c
13c
11c
21C
Router
23
To end user
25b
25a
19B
17b
15b
13b
11b
21B
Router
31
27
19A
17a
15a
13a
11a
21A
Router

FIG. 1

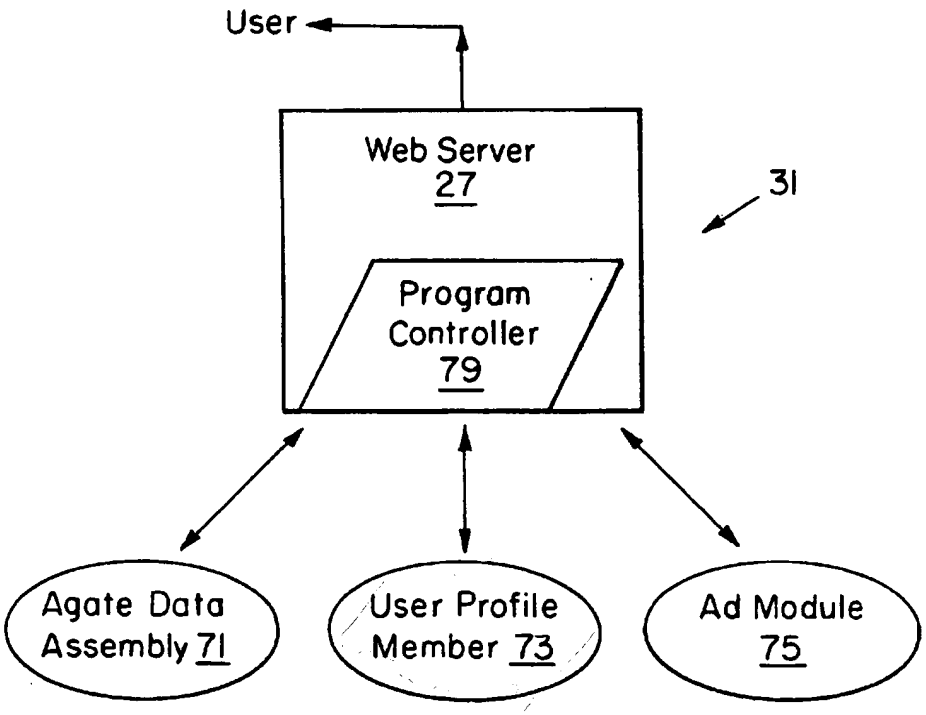

User
Web Server
27
31
Program
Controller
79
Agate Data
Assembly 71
User Profile
Member 73
Ad Module
75

FIG. 2

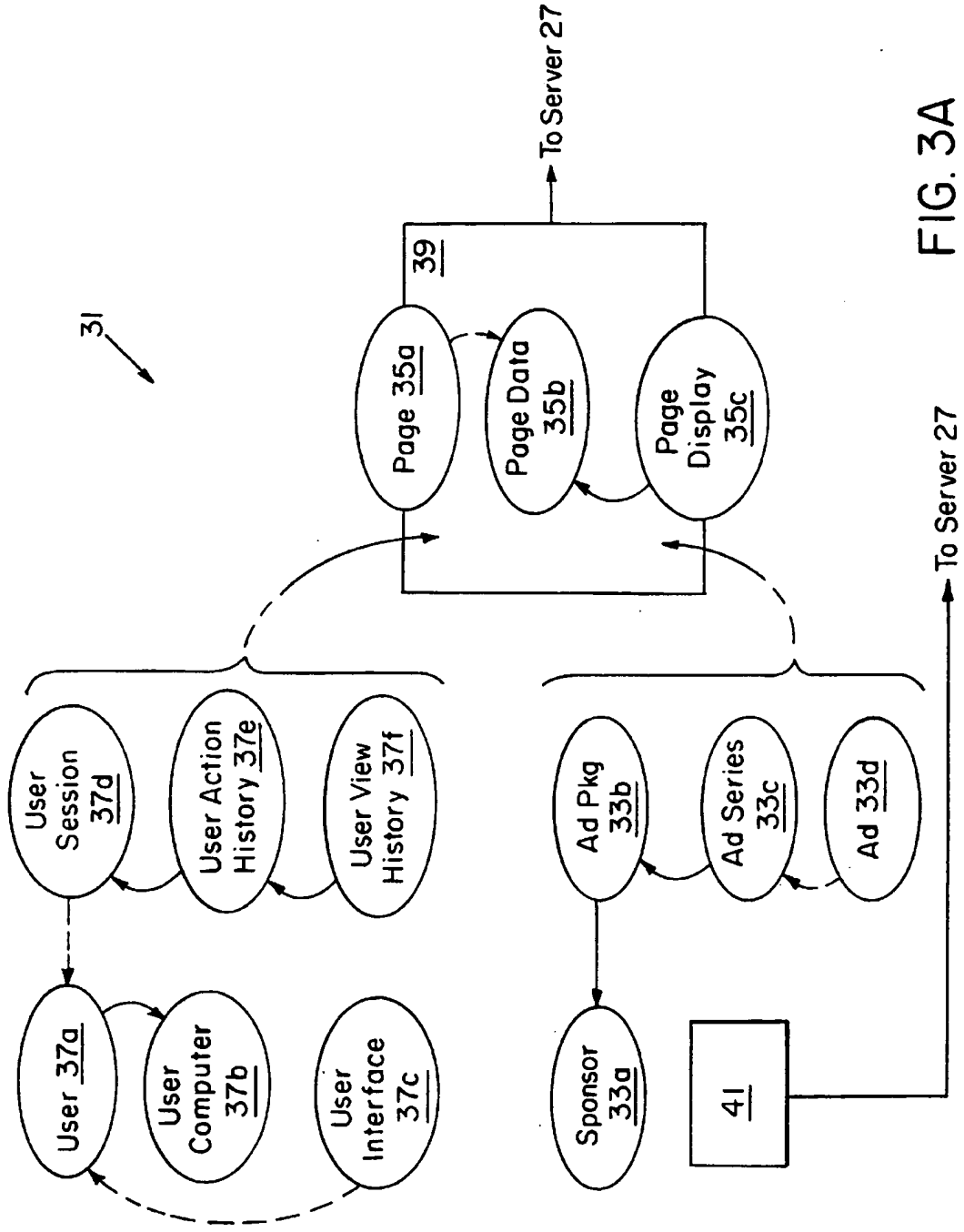
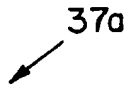

31
39
To Server 27
Page 35a
Page Data 35b
Page Display 35c
To Server 27
User Session 37d
User Action History 37e
User View History 37f
Ad Pkg 33b
Ad Series 33c
Ad 33d
User 37a
User Computer 37b
User Interface 37c
Sponsor 33a
41

FIG. 3A



User

- identifiers
  - nickname
  - password (optional)
  - e-mail
    - forward all messages received to that user
  - postal address
  - phone
  - credit card
- attributes
  - language
  - geographic
    - country
    - home zip
    - work zip
    - home area code
    - work area code
    - cities of interest
  - demographic
    - gender
    - age
    - income bracket (estimated or volunteered)
    - occupation (volunteered)
  - lifestyle
    - language
    - smoker
    - orientation
    - lifestyle (vegetarian)
    - race
    - drinker
    - marital status
    - music
    - weight
    - height
  - Sponsor interest list (user choose from)
    - DW
    - Pepsi
    - Coke

FIG. 3B

enabling technologies
(use/don't use flag for each for this user) Even if don't use, track presence for advertiser reporting.
helper apps list - can user hear audio, video, what browser
plug-ins list
NLO list
persistent ActiveX objects

37b

FIG. 3C

User Interface Profile
User computer ID
categories
category display

37c

FIG. 3D

User Session
referring link
start datetime
end datetime
computer ID
browser type

37d

FIG. 3E

User Action History
action datetime
session ID
ordinal sequence identifier
page ID
object clicked ID
object position on page
what was the context of the object that precipitated the action
1st, 2nd, 3rd item?
Right or left side

37e

FIG. 3F

User Viewing History 37f

open datetime
leave datetime
ID
ordinal sequence identifier
precipitating action ID
related object ID
item ID
item orientation
orientation relative to related object ID (either a page or an object). Must track each orientation separately, in case an ad encompasses an object.
top
bottom
left
right
background

FIG. 3G

Messages / Notices and Warnings 45

to user
from user
include identifier
subject
message
ad package ID (optional, system choice if null; if designated ID is expired package, look for next package by advertiser. If none, system choice)
Page ID (to forward a page reference)
Link to additional info
Messages will be sent either internally * or * through e-mail
Notices and Warnings will always be sent internally and be duplicated through e-mail if possible.
Delivery Date
Read date (specific user read msg on date / time)

FIG. 4B

43

User Homepage
- **Stock Table**
  - portfolio
    - *open*
    - *bid*
    - *ask*
    - *last*
    - *$ change*
    - *52wk high*
    - *52wk low*
    - *p/e*
- **Sports**
  - Scores from previous 2-3 nights games in table
  - News
- **Weather**
  - 5 day forecast for local area
    - *High*
    - *Low*
    - *Precip*
  - 5 day forecast for interested cities
  - Weather warnings if any for local or interested cities
- **Travel Schedule**
  - Selected/purchased items that are coming within one week (Table showing options)
  - Specials advertised to areas of interest
- **Directory**
  - Typically called numbers for an area (in a table, names are hotlinks for any with e-mail)
- **Messages**
  - Classified replies
  - Personals replies
  - Real Estate replies

FIG. 4A

33a

Sponsor
- company name
- user IDs
- contact info (for users to contact our sponsors)
  - phone
  - e-mail
  - URL
  - Fax
  - Mail
- account contact info
  - phone
  - e-mail
  - URL
  - Fax
  - Mail
- IP Domain list
- Demographic profiling
  - Type of business
    - SIC Code
    - SIC Industry name
  - Size of company
    - employees
    - revenues
    - earnings
  - Location
  - Local/Regional/National/Multi-national/Global
  - Producer
  - Publically traded (yes/no)
  - Exchange listings
- Customized Report Configurations-Standard Reports per ad
  - Packages included (default is all)
  - Variables included
  - Display preferences
    - Include regression ?
    - Graphical ?
    - Show control group ?

FIG. 5A

33b

Ad Package

- Sponsor ID
- Info for exact # purchases
  - **Number of Purchased Hits**
  - **Number of Purchased Clickthroughs**
- Info for scaled purchases (up to...)
  - **Max Hits**
  - **Max Clicks**
- Start Datetime (if not present, active until end date)
- End Datetime (if not present, is active after start date)
- # hits (derived)
- # clicks (derived)
- pricing of ad package
  - hit
  - clickthrough
  - order

FIG. 5B

33c

Ad Series

- package ID
- intended demographic profile(s) list
- category (product/service)
- daily start time-hr. of day
- daily end time
- Display Days of week
- Start Datetime (if not present, active until end date)
- End Datetime (if not present, is active after start date)
- Max. series views per user
- Max. series views per user per day

FIG. 5C

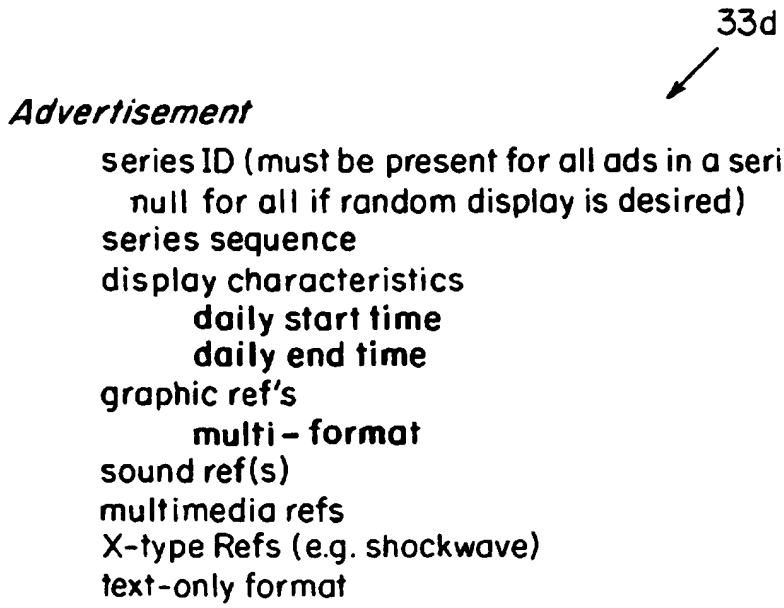

33d
Advertisement
series ID (must be present for all ads in a series, or
null for all if random display is desired)
series sequence
display characteristics
daily start time
daily end time
graphic ref's
multi-format
sound ref(s)
multimedia refs
X-type Refs (e.g. shockwave)
text-only format

FIG. 5D

METHOD AND APPARATUS FOR DETERMINING BEHAVIORAL PROFILE OF A COMPUTER USER

BACKGROUND

In traditional print media, the term "agate" was originally used to refer to any information printed in columns 1.5 inches wide in 5 point type (e.g., stock quotes). Today, agate is used to refer to time-sensitive, reference information that is not read linearly. Examples are telephone listings, classified advertisements, weather reports, sports scores and statistics, market data, books and recordings in print, and television and film listings.

Some types of agate require continual updating in the short term, like stock quotes, while other types have a longer life, like travel information and business directories. The newspaper industry is one of the primary suppliers of agate. Newspapers provide listings of stock quotes, television and radio programming, film schedules, and classified ads. A second group of agate suppliers are book publishers. From travel guides to books in print, a wide variety of books provide agate information that changes monthly or yearly.

Although many types of agate are traditionally found in publications (e.g., newspapers, magazines, and books), all agate can be placed into large indexed databases. Because agate is non-linear reference material, it is often more efficient to search for agate in a database, than to scan columns of a newspaper.

One of the largest pools of databases and electronic media is found on The Internet. The World Wide Web (Web) is a two-year-old protocol used to create and publish documents on the Internet. Web documents may contain graphics, text, sound, video or any combination of these. Web documents can include "hyperlinks" which are highlighted areas of information in one document that, when user-selected, open a related document. In late 1994, "forms" were added to the Web to make it interactive. Previously, Web pages could only be used to display information or point to other Web sites where information was available. The 1994 change allowed those publishing Web pages to publish "forms", i.e., documents that include blank spaces to be completed by users and then returned to the publishing computer, thus allowing interactivity.

Publishing information on the Web requires two software components. Electronic publishers must run HyperText Transfer Protocol (HTTP) server software. Users scanning or searching on the Internet must use Web browser software. A variety of firms including Microsoft, Oracle, Netscape Communications, Spyglass, Spry, Netcom, and EINet all distribute Web software.

A variety of businesses are now offering information, some of it agate, on the Internet. One example is newspaper distribution on the Internet. However, the agate found in newspapers is at least twelve hours old. In the case of stock quotes, the information found usually recaps trading for the previous day, listing the high, low and closing prices as well as the number of shares traded. While this information is sufficient for tracking investments, investors often require real-time information to trade on the market.

Other examples of businesses that offer agate information on the Internet are Movie Phone whose World Wide Web Site is WWW.777film.com and Securities APL (at WWW.secapl.com) which allows users to look up individual stock quotes (delayed 15 minutes).

To date, however, there is no general agate provider on the Web.

SUMMARY OF THE INVENTION

The present invention uses agate information to determine the profile of a computer user, and in particular the behavioral or psychographic profile, as distinguished from the demographic profile, of a user. To accomplish this, the present invention provides (i) a data assembly for displaying customized agate information to a computer user, and (ii) a tracking and profiling member for recording user activity with respect to agate information displayed through the data assembly. Over time, the tracking and profiling member holds a history and/or pattern of user activity which in turn is interpreted as a user's habits and/or preferences. To that end, a psychographic profile is inferred from the recorded activities in the tracking and profiling member.

Further, the tracking and profiling member records presentation (format) preferences of the users based on user viewing activity. Preferences with respect to color schemes, text size, shapes, and the like are recorded as part of the psychographic profile of a user. In turn, the psychographic profile enables the data assembly to customize presentation (format) of agate information, per user, for display to the user.

In the preferred embodiment, the data assembly displays agate information and/or advertisements (combined in a common screen view or separately in respective screen views). The advertisements (stored in an advertisement module, for example) are displayed to users in accordance with the psychographic profile of the user.

The tracking and profiling member also records demographics of each user. As a result, the data assembly is able to transmit advertisements for display to users based on psychographic and demographic profiles of the user to provide targeted marketing.

In accordance with another aspect of the present invention, there is a module (e.g., advertisement module) that records history of users viewing the advertisements. For each advertisement, the module records (i) number of times viewed by a user; (ii) number of times selected for further information by a user, and/or (iii) number of purchases initiated from display of the advertisement to a user.

In addition, a subroutine coupled to the module performs a regression analysis on the recorded history of users viewing the ads. The subroutine refines profiles of target users based on the regression analysis. Preferably, the regression analysis weights the relative importance of psychographic and/or demographic characteristics of users. As such, over time, the advertisements become better targeted to users having an interest in said information (content and presentation/format of ad), and hence the invention method and apparatus provides automatic targeting of audiences (target users) and self-tailoring of target profiles.

The preferred embodiment utilizes object oriented programming techniques to provide a User Object. The User Object tracks user actions in a history profiling table. The User Object utilizes an updating routine which maintains the history profiling table by storing in the table an indication of a user's actions, i.e., computer activities, with respect to displayed agate information.

In accordance with another aspect of the present invention, there are Agate Objects for providing the agate information and a Sponsor Object. In a preferred embodiment, the agate information includes stock information, advertisements, sports statistics, weather reports and the like. With regard to stock information, an Agate Object routine receives stock data on line, parses the

data and makes a value-added calculation. As a result, the stock information is made searchable by variables such as price-earnings ratio, and the like.

The Sponsor Object categorizes advertisement or other sponsor provided information according to content and presentation, including colors used, size, shape, and whether audio and/or video components are involved. An advertiser profile building routine automates the process of identifying colors, size, shape, and whether video and/or audio are involved.

Also the Sponsor and User Objects track how many times each piece of advertisement information is shown to, is selected by and/or spawns a purchase by users. In other words, the Sponsor and User Objects track performance of sponsor provided information, especially advertisements. In the preferred embodiment, a performance routine employs regression techniques to provide performance reports. The performance routine may also be run (executed) remotely by suppliers of the advertisement information.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of preferred embodiments and the drawings in which like reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention.

FIG. **1** is an overview of a computer network environment in which the present invention is employed.

FIG. **2** is an overview of a general embodiment of the present invention.

FIGS. **3***a*–**3***g*, **4***a* and **4***b*, and **5***a*–**5***d* are schematic diagrams of a preferred embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Illustrated in FIG. **1** is a plurality of networks **19***a*, **19***b*, **19***c*. Each network **19** includes a multiplicity of digital processors **11, 13, 15, 17** (e.g., PC's, mini computers and the like) loosely coupled to a host processor or server **21***a*, **21***b*, **21***c* for communication among the processors within that network **19**. Also included in each network **19** are printers, facsimiles and the like. In turn, each host processor **21** is coupled to a communication line **23** which interconnects or links the networks **19***a*, **19***b*, **19***c* to each other to form an internet. That is, each of the networks **19** are themselves loosely coupled along a communication line **23** to enable access from a digital processor **11, 13, 15, 17** of one network **19** to a digital processor **11, 13, 15, 17** of another network **19**. In the preferred embodiment, the loose coupling of networks **19** is the Internet.

Also linked to communication line **23** are various servers **25***a*, **25***b* which provide to end users access to the Internet (i.e., access to potentially all other networks **19**, and hence processors **11, 13, 15, 17** connected to the Internet). The present invention is a software program **31** operated on and connected through a server **27** to the Internet for communication among the various networks **19** and/or processors **11, 13, 15, 17** and other end users connected through respective servers **25**. In the preferred embodiment, the server **27** is a Digital Equipment Corp. Alpha server cluster (e.g., 2400–8000 Series), or a multiplicity of similar such servers. Server **27** runs Oracle 2.0 Webserver as HyperText Transfer Protocol (HTTP) server software to support operation of present invention program **31**.

Upon an end user logging onto program **31** through common Internet protocol, program **31** generates an initial screen view (commonly known as the "Home Page") for display to the end user. During the user's first visit, the initial screen view provides menu selections of various agate information (e.g., stock market data, weather, sports, etc.) Upon user selection (using a click of a mouse or other input means) of a menu item, program **31** displays corresponding up-to-date information. Similarly, each time the user selects another menu item, program **31** generates and displays current agate information relating to that selection.

In addition, program **31** records the user's selections and his viewing activity with respect to the agate information. In particular, for each piece of displayed agate information, program **31** records the date and time of user viewing and the format which the user has selected for viewing. After multiple sessions, a pattern of the user's viewing actions or viewing habits is obtained, from the recorded activity. In turn, certain inferences about the user are made based on the user's viewing habits and the specific pieces of agate information he views, including content and presentation of that information. To that end, for each user the present invention program **31** creates a user profile from the agate information viewing habits of the user. The system then generates a custom Home Page, including a user's preferred (content and presentation) agate information. On subsequent visits to program **31** (as a Website) by the user, program **31** displays the customized Home Page for that user instead of the initial Home Page.

Based on the created user profile for a given user, program **31** enables sponsors to better direct their advertisements and enables advertisements to be tailored to target users' display preferences. That is, both subject matter/content and presentation of advertisements are able to be customized to the end user's preferences due to the information tracked and recorded (i.e., the created user profile) by program **31**.

Accordingly, program **31** in its most general form has an agate data assembly **71**, a user profiling member **73**, an advertisement module **75** and a program controller **79** as illustrated in FIG. **2**. The agate data assembly **71** stores the various agate information for user viewing. The user profiling member **73** records information regarding each user, including a user's identification, categories of interest and the user's display preferences of each category. Advertisement module **75** holds sponsor information and their advertisements, with a target audience profile indicated for each advertisement.

Program controller **79** is a series of routines (methods) on Web server **27**.

The program controller **79** responds to commands (e.g., log in and menu selections) transmitted over the Internet by an end user, and obtains the necessary information from agate data assembly **71**, user profiling member **73** and advertisement module **75** to generate and display appropriate screen views to the user.

In particular, in response to user login, program controller **79** checks with the user profiling member **73** to determine whether the user has in the past logged on to program **31** or is a new user. In the former case, according to records in the user profiling member **73**, the program controller **79** obtains preference information for that user and using agate information from the agate data assembly **71** generates an initial screen view formatted according to the user's recorded preferences. Program controller **79** transmits the generated screen view through Web server **27** for display to the user.

In the latter case (a first time/new user), program controller **79** assigns a unique users computer ID upon user login.

This, in turn, enables user profiling member **73** to initialize tracking of viewing activity of the new user immediately following login. Program controller **79** obtains initial agate information from agate data assembly **71** to display the Home Page to the new user. Program controller **79** also obtains user identification information from the user to assign a user name and password at the user's convenience.

In either case, throughout the session, program controller **79** responds to user selections and viewing actions (screen formatting commands/requests, menu selections, etc.) by (i) using the agate data assembly **71** to obtain and display the requested information and (ii) using the user profiling member **73** to record the user's activities and thus build a psychographic/behavioral profile of the user.

With respect to the advertisement module **75**, program controller **79** obtains sponsor submitted advertisements from module **75** and generates a screen view formatted according to user preferences as determined from the psychographic profile in the user profiling member **73**. That is, program controller **79** enables display of advertisements customized to the user, as to content and presentation (i.e., colors used, orientation on the screen, audio/video components, and the like). Program controller **79** obtains the content from the advertisement module **75** and the presentation details for the subject user from the user profiling member **73**.

In addition, for each advertisement, advertisement module **75** (and/or user profiling member **73**) records (a) the number of times and/or number of users to whom the advertisement has been displayed, (b) the number of times/users who have requested more information (via a click of a mouse on a corresponding menu selection) regarding the advertisement, and when possible (c) the number of purchases obtained through program **31**'s display of the advertisement. As such, advertisement module **75** holds performance data for each advertisement, and hence enables program controller **79** to provide performance reports to sponsors who log on to program **31**. Various regression techniques and the like are used in the performance reports in a manner consistent with the state of the art.

In the preferred embodiment, program **31** is implemented as an object oriented program discussed next with reference to FIGS. **3***a* through **5***b*. Each object is formed of data and subroutines (methods) for acting on the data. The data is preferably stored in tables and each table is formed of a multiplicity of records or fields of information. The information held in a record in respective tables of the objects is illustrated in FIGS. **3***b* through **5***b* and discussed below with the details of each object. It is understood however that other program means, techniques, data structures and program designs for present invention system **31** are suitable. Thus the details of the preferred embodiment in FIGS. **3***a* through **5***b* are for purposes of illustration and not limitation.

In FIG. **3***a*, a set of User Objects **37** provides the functional equivalent of the user profiling member **73** of FIG. **2**. A set of Page Display Objects **35** provides the functional equivalent of agate data assembly **71** of FIG. **2**. A set of Sponsor Objects **33** provides the functional equivalent of the advertisement module **75** of FIG. **2**. The main routine **39** of program **31** in FIG. **3***a* functions similarly to the program controller **79** of FIG. **2** as will become apparent in the following discussion.

Turning to FIG. **3***a*, the purpose of the set of User Objects **37** is to identify users and maintain a user profile for each user. Included in the set of User Objects **37** is general information about users and their computers, as well as specific data on each computer session undertaken by the users. In particular, for each set there is a User Object **37***a*. User Object **37***a* identifies a respective user by nickname (user chosen), password (user chosen), and optionally E-mail address, postal address, telephone number, credit card number, and the like. User Object **37***a* also provides language, geographic, demographic and lifestyle information about the user. To accomplish this, User Object **37***a* stores a separate record for each of the above mentioned information, the collection of records forming the table or data of User Object **37***a*. FIG. **3***b* illustrates the fields or records of information employed by User Object **37***a* in the preferred embodiment.

Also for each user, there is a User Computer Object **37***b* and a User Interface Object **37***c*. For each user's computer, User Computer Object **37***b* provides an indication of the limitations and capabilities of the user's computer system. For example, User Computer Object **37***b* lists whether the user's system provides audio and/or video display, and what Web browser software is utilized by the user's system. An outline of the table/data set of a User Computer Object **37***b* in the preferred embodiment is illustrated in FIG. **3***c*.

The User Interface Object **37***c* provides a unique (preferably numeric) identifier of the user. The User Interface Object **37***c* also provides indications of categories of interest to the user and a primary screen display for each category customized to that user. The foregoing information is held in records illustrated in FIG. **3***d*. In the preferred embodiment, the various categories of interest include stock trading portfolio, sports, news, weather, theater and television schedules, telephone directory, travel data, classified ads and personals information, and the like. Display preferences include orientation, color scheme, screen quadrant/location and the like, indicated with respect to the category of information. For example, one user may tend to like stock information displayed in tabular form on a blue background and weather displayed on a map scene. Another user may prefer stock information displayed in a running 1-line quote at the bottom of the screen and weather displayed in a tabular format by city on a green background, and so forth.

The history of user activity with executed program **31** is also maintained by the set of User Objects **37** (FIG. **3***a*). Specifically for each user, a User Session Object **37***d*, User Action History Object **37***e* and User Viewing History Object **37***f* record the following as illustrated in FIGS. **3***e*–**3***g*.

Each time a user logs on to program **31**, User Session Object **37***d* records the starting date and time and ending date and time of the session. User Session Object **37***d* also records (a) the referring link from which the user accessed program **31** (e.g., a so called "bookmark" or "hyperlink" which effectively stores and forwards the Web site address of program **31**), (b) the user's identification number (e.g., as stored in a so called "cookie" passed by the user's computer upon logging in), and (c) an indication of Web browser software employed by the user's computer. FIG. **3***e* illustrates the records created by User Session Object **37***d* to accommodate the foregoing data.

The User Action History Object **37***e* stores each click of a mouse and corresponding cursor position to effectively record the user's motions/movements in a session. In particular, as illustrated in FIG. **3***f*, User Action History Object **37***e* records (a) date and time of action, (b) session identifier (indicating in which session of the User Session Object **37***d* the subject action occurred), (c) sequence or order number of the action in the series of actions that occurred in a common session, (d) identification of screen view displayed at time action occurred, (e) identification of

item selected by user (via click of mouse with cursor positioned on item), and (f) screen position of selected item (e.g., first, second or third menu item, right or left side).

The User Viewing History Object **37***f* stores information indicative of the screen views displayed to the user in a session. Specifically, User Viewing History Object **37***f* records an item identification (either agate or advertisement) and orientation of that item for each item displayed to (and hence viewed by) the user in a session. Orientation is noted relative to a page/screen view or an object identified in the "related object ID" field of the User Viewing History Object **37***f*. Preferably, orientation is indicated as being top, bottom, left, right or background of the screen view. The Viewing History Object **37***f* also records an identifier (of each screen view), ordinal sequence number (number order of screen view within series of screen views displayed in a session), and an indication of the action from which this screen view resulted (i.e., a reference to a corresponding User Action History Object **37***e*). Lastly, the User Viewing History Object **37***f* records date and time of screen opening and closing for each screen view. The foregoing is stored in an object table record illustrated in FIG. **3***g*.

Returning to FIG. **3***a*, the set of Page Display Objects **35***a*–**35***c* defines the screen views transmitted and displayed to end users. A Page object **35***a* cross references a User Interface Object **37***c* which specifies which Page Display Object **35***c* and which agate information (content and presentation) is appropriate for the current user. Page Data Objects **35***b* hold the agate or other data to be displayed to end users. Included are advertisements (objects themselves) which may be integrated into the agate data. Preferably advertisements are positioned along the periphery (i.e., above, below, left or right) of the agate data, as defined by a respective Page Display Object **35***c*. Accordingly, Page Data Objects **35***b* support Page Display Objects **35***c* which outline the possible screen content and presentation formats in which agate data advertisements are to be displayed.

In the preferred embodiment, Page Display Object **35***c* provides outlines for a Home Page, Financial Pages (screen views), Sports Pages (screen views), Weather Pages (views), a Media Schedule Page, Directory Page, Travel Options Page, Classified Ads Pages, and Real Estate Pages (screen views) as specified in Appendix I. Each is discussed next with reference to FIGS. **4***a*–**4***b* and Appendix I.

Referring to FIG. **4***a*, Page Display Object **35***c* defines a Home Page **43** format for program **31**. The preferred Home Page format includes six categories of agate information stock data, sports, weather, travel schedules, directory information and Classified/Personals/Real Estate messages. The stock data category provides portfolio information such as opening price per share, change in price from last posting, 52 week highs and lows, etc. If a user selects the stock data category (i.e., as a menu selection) for further viewing, a Page Display Object **35***c* in the form of a Financial Page (screen view) is generated in one of the alternative formats outlined in Appendix I.

Briefly, five types of Financial Pages Objects **35***c* are utilized by the preferred embodiment. They are named "Stock Page", "Company Page", "Expert Articles Page", "Expert Guide Page" and "Show Me Some Page" (see Appendix I). The "Stock Page" includes (a) data on user-selected stocks in a tabular format, a portfolio value graph and message window (for quickly moving companies present and titles of articles by experts in the field), (b) a tracking list, (c) indices such as Dow Jones Industrial Average and NASDAQ, and (d) a ticker customized to the user (user-selected stock). The expert articles are formatted on screen views for display according to the "Expert Articles Page" format. The "Company Page" format includes the trading symbol/code, stock information and corporate data about a specific company. The "Expert Guide Page" and "Show Me Some Page" formats enable the user to interactively create his own screen display of stock information. In particular, the Expert Guide Page surveys the user on his investment interests. Using the Expert Guide Page and Show Me Some Page formats, Page Display Object **35***c* then displays names of companies found to match the user provided criteria.

In each of the foregoing formats, the preferred embodiment includes incorporation of ads or sponsorship indications as top and/or closing banners. The Home Page **43** (FIG. **4***a*) provides scores of recent games and news in the "sports" category. If a user selects the sports category from the Home Page, a Page Display Object **35***c* generates various screens bearing sports information and news. For sports pages/screen views, there are seven page/screen formats of Page Display Object **35***c* outlined in Appendix I. Briefly, a "General Sports Page" format includes (a) game scores and standings, by league, for professional and collegiate sports, and (b) player standings (professional and collegiate) for baseball, football, hockey and basketball. Statistics are updated and displayed during play of a game, so that the General Sports Page provides game-in-progress statistics in realtime. Also a news window is provided for each sport with a link to a "News Page" (object) for more news. The "News Page" format includes information regarding major trades, signings and injuries. In the preferred embodiment, a scrolling window of latest news is also included.

A "Team Page" format provides a roster of a given team. Thus program **31** has several Team Page Display Objects **35***c*. The roster lists players by name, jersey number, position and some statistics. A "Team v. Team Page" format lists similar information as the "Team Page" format but for two teams in facing columns. Indications of favored teams and game scores for an entire season are also provided on a "Team v. Team Page" Display Object **35***c*.

Player information is provided in three formats—a "Player Page" format, a "Player v. Team Page" format and "Player v. Player Page" format. Comparison of a player's statistics to his team's statistics is provided in a "Player v. Team Page" Display Object **35***c*. Comparison statistics of two players on different teams is provided in the "Player v. Player Page" format.

Further, some of the above sports page formats allow advertisements to be displayed at the top and/or bottom of the screen view in the preferred embodiment.

Referring back to FIG. **4***a*, the Home Page **43** also provides a weather category. Shown on the Home Page **43** under that category is a long-range (e.g., 5-day) forecast for the user's local area and cities of interest to the user. Also that category provides storm warnings and the like for local areas and cities of interest. Upon user selection of the weather category, a Weather Page Display Object **35***c* enables display of weather information in one of two formats—a National Weather Page and a Regional Weather Page (Appendix I). Briefly, the "National Weather Page" format displays temperature and precipitation indications across a relevant map, along with textual descriptions. Audio forecast readings are also provided. Incorporation of a sponsorship ad is provided at the top and/or bottom of the screen view (termed "banners" in Appendix I). The "Regional Weather Page" displays (a) a regional map (e.g.,

state) with temperature and precipitation indications, (b) a graphical forecast (e.g., high and low temperatures and sun/cloudy, rain or snow predictions for the next several days), and (c) a detailed forecast with tabular and textual descriptions. Also the Regional Weather Page provides weather warnings and advertisements at the bottom of the screen view in the preferred embodiment.

Referring back to the Home Page **43** of FIG. **4***a*, also included is a Travel Category. Data/information displayed in that category include travel and other ticket purchases of a user within an approaching date and specials advertised in areas of interest to the user. Upon user selection of the Travel Schedule Category of the Home Page **43**, a Travel Page Display Object **35***c* enables display of a Travel Options Page (screen view).

The format of a "Travel Options Page" of the preferred embodiment is detailed in Appendix I. Preferably, there is one Travel Options Page for each of different cities. Briefly, for each Travel Options Page Display Object **35***c* there are three data parts. A first part is a table of transportation options, including departure, arrival and reservation information for airlines, buses, boats and trains. The second part is hotel information in a given destination (subject city). Preferably this information is in tabular form. The third data part of a Travel Options Page Display Object **35***c* is information regarding rental car options. Further the Travel Options Page format allows an advertisement to be displayed at the top of the screen view and at the end of a Travel Options Page.

Referring back to Home Page **43**, FIG. **4***a*, the Directory category provides phone numbers typically called by a user. The supporting Directory Page format for this category is a table of names and corresponding mailing addresses (i.e., street, city, state, zip code), telephone and facsimile numbers, E-mail address and URL (universal resource locator). Preferably for those names with an E-mail address, the indicated name functions as a screen menu selection using hyperlink techniques.

The "Messages" category of the Home Page **43** includes information relating to personals advertisements, classified advertisements and real estate advertisements. Upon user selection of this category, a search is initiated with user provided parameters. An appropriate Page Display Object **35***c* enables display of the results of the search using a "Personals Page", "Classifieds Page" and/or "Real Estate Page" format outlined in Appendix I. Briefly, included in a Personals Page/screen view is geographic, demographic and life style information. Preferably, sponsor provided advertisements are able to be inserted at the top of the screen view and at the end (i.e., after) a Personals Page screen view.

The format of a "Classifieds Page" includes accommodations of sponsor provided advertisements (e.g., at a beginning screen view and/or end screen view of the Classifieds Page screen view). The "Classified Page" format also includes indications of the requested item, make/model/year, price and a description of the subject item.

Each Real Estate Page follows one of three formats—a "Citywide Listings Page", "Selected Listings Page" and "Individual Listings Page" detailed in Appendix I. Briefly, the "Citywide Listings Page" format provides a table of real estate properties indicating address, price, square footage, etc. Also provided is beginning screen view and end screen view advertisement ability. The "Selected Listings Page" format provides a table of user selected properties/listings, with more details than the "Citywide Listings Page" format. For example, number of rooms, heat type, parking, yard/deck and the like are indicated in the table. Advertisement ability across the top and bottom of the screen view is also indicated by the "Selected Listings Page" format. The "Individual Listings Page" format includes the details of the "Selected Listings Page" with added textual description, photo, city information and contact information. Advertisements at the beginning and end of the page/screen view are enabled by the "Individual Listings Page" format.

In the preferred embodiment, there is also a Media Schedule Object and respective screen view, accessible through the Home Page **43** of FIG. **4***a*. The format of the Media Schedule Page includes three tables of information—one table for television listings, one for film listings and one for live performance listings as illustrated in Appendix I. The television table lists for each program (show): the channel airing the program, start and end times, and other related information (e.g., rating, rerun, etc.) For each film, the film table lists, among other information, cinema where playing, show times, length in time, rating and indication of type of film. The live performance table includes symphony and theater performance schedules (show times) and place/theater.

In the preferred embodiment, program **31** displays user generated messages and system generated notices (or warnings) to the end user in addition to the foregoing "Pages"/screen views of category information. FIG. **4***b* illustrates the preferred Message/Notice Object **45** screen view format. In the case of one user sending a message to another user through program **31**, the displayed message includes indications of the sending and intended receiving users along with an identifier, subject and message, among other indicia. Attachments or additional information are enabled through a page reference (Page ID) and/or link indication. If the recipient selects (by a click of a mouse) the page reference or link indication, program **31** generates a screen view (i.e., Page Display Object **35***c*) displaying the additional information. Further messages are transmitted through E-mail or internally/local to program **31**.

In the case of notices and warnings, program **31** initiates and transmits these. An intended receiver, notice/warning identifier, message, page ID and/or additional information link are included, similar to those described above for user-to-user messages, among other indicia as illustrated in FIG. **4***b*. Program **31** transmits notices and warnings both internally during execution/operation of program **31** and through E-mail.

In either case (user generated message or system notice/warning), advertisements are allowed to be integrated. To accomplish this, the "Message/Notice Page" format **45** indicates an advertisement package ID (explained below).

In addition to the features of the Home Page **43** illustrated in FIGS. **4***a* and **4***b* and discussed above, the preferred embodiment provides user customization in the following ways. When a user is traveling away from the computers that he normally logs on through (i.e., home and/or office), program **31** enables the user to customize the initial screen view (i.e., Home Page **43**). This is accomplished using the City Pages Objects outlined in Appendix II. In particular, an initial City Page screen view provides user access to travel options, media/cultural event schedules, Corporation Information, Weather and Directory information, all with respect to a specific city (e.g., destination cities in a business trip). To that end, from the City Page screen view, a Travel Options Page and corresponding object (from Appendix I) may be generated for the user's current town location and/or home town. Also, the City Page is an object (like Media

Schedule Page Object in Appendix I) having a table listing media and cultural events, locations/channels of the same, and begin and ending dates and times, among other brief information.

From the City Page, as with the Home Page **43**, a user is also able to obtain information on specific local companies utilizing Financial Page Objects (Appendix I). Preferably a Company Page Object is utilized. Thus, corporate information is presented in a table listing company name, and indications of industry, revenues and contact information (street address, telephone/facsimile numbers and E-mail address).

Information about the local weather as accessed from the City Page is preferably presented in a graphical five-day forecast format, similar to that described for the Regional Weather Page Object in Appendix I. Lastly, the City Page provides a Directory of numbers in the subject city which the user has previously accessed and hence are probably meaningful/useful to the user while staying in that city. Each entry in the Directory includes a name, address, telephone/facsimile number, and E-mail address. Also in the preferred embodiment, indications of changes of address are provided in the Directory.

In addition, program **31** enables user customization of content and format of screen views for each category of information. That is, for each of the Home Page **43** and City Page categories (financial information, sports, weather, travel, telephone directory, personals and classifieds), the user is able to request structured data, preformatted data packages and/or value-added analyses from program **31**. Thus if a user provides certain data and an indication of desired form of analyses (ranging from a numeric indication to a simple yes/no indication), program **31** provides prepared analytical views for the user selected data in the subject category. Alternatively, program **31** provides prepared profiles to assist users in selecting data. In response to a user providing a simple analytical statement/request, program **31** responds with data that fits that request. For example, if the user requests college stocks, program **31** suggests some. Also direct user selection of category items and display format is enabled through this feature.

With respect to each of the Home Page **43** and City Pages categories, the foregoing user customizations are further described in Appendix III.

Lastly, program **31** enables user customization of Home Page **43**. To that end, upon a user logging in (subsequent to a first time) to program **31**, one category at a time is addressed to define a default. In subsequent uses of program **31**, data appears in order of most frequently selected categories of the user, unless the user specifies otherwise. Also, categories that a user selects to view further which are not on his Home Page are added with three options: customize, remove from first page, or move to a user-specified xyz position. Also program **31** defaults to the current date information only, unless otherwise designated by the user.

Referring back to FIG. **3***a*, a set of Sponsor Objects **33** stores sponsor provided information, including advertisements desired to be displayed and details regarding the same. FIGS. **5***a*–**5***d* illustrate the set of Sponsor Objects **33**, referred to as Sponsor Object **33***a*, Ad Package Objects **33***b*, Ad Series Objects **33***c*, and Ad Objects **33***d* in the preferred embodiment and detailed next.

For each sponsor (or advertiser), a corresponding Sponsor Object **33***a* (FIG. **5***a*) stores in a table (or sponsor directory) the company name, numeric identification unique to that sponsor, user contact information and program **31** administrator contact information. Also Sponsor Object **33***a* records an indication of the demographic profile of the sponsor company itself in order to advertise to the sponsor company user as is appropriate. Further, Sponsor Object **33***a* indicates standardized report configurations (display preferences, etc.) for that sponsor.

Each sponsor has one or more ad packages maintained by respective Ad Package Objects **33***b* of the sponsor. In each Ad Package Object **33***b* (FIG. **5***b*) there is indicated the sponsor ID, start and end dates and times, and pricing of the ad packages. The pricing may be dependent on the number of times the ad is viewed by users (i.e., a "hit"), number of times a user selects to view more information from the ad (i.e., a "click through") and/or the number of times an actual order is generated. Pricing by the number of hits and number of click throughs by exact numbers or maximum numbers is indicated in the Ad Package Object **33***b*. Thus Ad Package Objects **33***b* serve as billing entities for the program **31** administrator. Also Ad Package Object **33***b* records the number of hits and click throughs as tracked/monitored during user operation of program **31**.

Specific to desired ads, each sponsor has one or more Ad Series Objects **33***c* (FIG. **5***c*). An Ad Series Object **33***c* (FIG. **5***c*) provides an indication of whether a given advertisement is singly or serially displayed, the category of the information, and the demographic group pre-requested by the sponsor to be shown that advertisement. In a preferred embodiment, the sponsor specifies in Ad Series Object **33***c* the required and/or preferred psychographic and/or demographic criteria and relative importance (e.g., weight) with respect to each criterion. Further, the sponsor specifies in Ad Series Object **33***c* a minimum total weight of criteria to be met by a user to qualify the user to view the ad series. Also Ad Series Object **33***c* includes a reference to an Ad Package Object **33***b* (via an ad package identification), the hour of the day in which the ad/ad series is to start and end, the days of the week on which the ad/ad series is to be displayed, and the beginning and ending dates and times of the ad/ad series. Also for serially displayed advertisements, Ad Series Object **33***c* indicates the maximum number of views in a series to be displayed per user and per user per day.

Each ad forms a corresponding Ad Object **33***d* as illustrated in FIG. **5***d*. For a given advertisement, Ad Object **33***d* indicates to which series the advertisement belongs. To effectuate this, the Ad Object **33***d* indicates a series ID which references an Ad Series Object **33***c*, and indicates a series sequence (i.e., the ordering of the ads in a series). Ad Object **33***d* also includes the starting and ending time for display of the ad each day. Ad Object **33***d* also provides references to graphic, sound, and multimedia portions of an advertisement. A text-only format of an advertisement is used for users receiving messages on their own E-mail service or on a text-only browser (e.g., Links systems for VAX/VMS operating systems) rather than through the messaging feature of program **31**.

Another part of the Sponsor Objects **33***a*–*d* is a computer subroutine **41** (FIG. **3***a*) which provides performance reporting. This enables the sponsors of the advertisements to obtain reports on successful use of the advertisements. The types of reports provided in the preferred embodiment of program **31** are outlined in Appendix IV. In that Appendix, "HTs" means hits and "CTs" means click throughs.

Briefly, an Overview Report provides a review by ad package. The number of hits and number of click throughs purchased and achieved are indicated among the cost of the package and date specified by the ad package.

A Detailed Package Report provides information on individual ad packages, including showing the ads included in the package with video and audio portions intact. The demographic profiling requested and demographic breakdown of success with respect to a control group are also provided in the Detailed Package Report. Also the number of hits and click throughs purchased and achieved are designated in the Detailed Package Report.

In the Demographic Response Rates Report, all ad packages of a sponsor or selected ones are compared. In particular, the ad success by the sponsor-targeted demographic groups is compared. Further the reporting subroutine **41** of program **31** calculates a regression on the targeted demographic groups for the ads, and the results of the regression calculation are used to suggest other demographic characteristics that are important factors in the number of click throughs and/or number of purchases. The advertiser may also run a complete regression report for all or certain ad packages.

A Psychographic Profiling Report is similar to the Demographic Response Report except a psychographic profile is used instead of a demographic profile. The reporting subroutine **41** makes regression calculations, and results of the calculations enable program **31** to suggest other psychographic characteristics that are important factors in the click throughs and/or purchases of the ads for a given sponsor.

Other report formats include a U.S. or world mapping to show user density of program **31** versus a sponsor's click through or purchase density. Traditional regression reporting is also enabled. Custom reports which allow the sponsor to select ad packages to be analyzed and variables to consider are also enabled by reporting subroutine **41**.

Use and operation of the preferred embodiment of the present invention is as follows. The following is for purposes of illustration and not limitation.

Stored locally on a user's PC is a cookie (technology by Digital Equipment Corp.) for identifying the user and his preferences. The user logs onto the Internet **29** and enters the URL or Website address of program **31** which initializes main routine **39**. The URL request is received by Web server **27** which in turn transmits (a) a login advertisement screen view (i.e., from Page Objects **35***a,b,c* and Ad Package Object **33***b*) and (b) a request for a cookie that indicates whether this is a first time user. When no cookie is present, the main routine **39** transmits through server **27** the standard introductory screen view page (Home Page **43**, FIG. **4***a*).

Preferably the Home Page **43** (FIG. **4***a*) is an HTML (HyperText) document generated through the set of Page Objects **35***a,b,c*. The Home Page **43** describes to new users the data available at the program **31** Website and allows existing users to log in. The Home Page **43** is formed of several graphical and text documents in the HTML and Java formats. For example, behind the "stock data" menu selection a Stock Exchange ticker flashes, and behind the "weather" option, a display of clouds swirling over San Francisco and then sunshine over Washington, D.C. is shown. A clip of a newly released movie plays behind the "Media Schedule" option, and sports scores scroll behind the "Sports" option. At the bottom of the screen view are login fields and prompts.

For a new user, the Home Page **43** effectively requests a user name and password. In response to the user-provided data, main routine **39** immediately builds a cookie if possible. Included in the newly built cookie is a unique user identification code (preferably numeric), time and date of login, and computer identification number to distinguish between home and work logins. Main routine **39**/server **27** transmits the created cookie to the user's PC for storage and future use.

Upon the new user selecting a displayed option (by moving the cursor to the desired option and depressing/clicking the mouse button), a request is generated and sent to main routine **39**/server **27**. In response, program **31** obtains a screen view corresponding to the selection as generated through Page Objects **35***a,b,c*. Main routine **39** transmits the screen view for display to the user.

Program **31** also creates a new User Object **37***a*, User Computer Object **37***b*, User Interface Object **37***c*, User Session Object **37***d*, User Action History Object **37***e* and User Viewing History Object **37***f* for the new user. User Object **37***a* records the user-provided name and password used to create the cookie. User Session Object **37***d* records the login time. User Action History Object **37***e* records the selection activity of the user. The User Viewing History Object **37***f* also registers the open and leave times for the initial login advertisement screen view and notes what elements were displayed at that time. Also the Ad Package Object **33***b* responsible for the initial login advertisement screen view records a "hit" by the new user.

Say for example, the new user selected (i.e., "clicked on") the "Stock Data" option from the Home Page. Program **31** responds by displaying a screen view featuring the exchange prices from various global exchanges. Main routine **39** also enables a banner to appear at the top of the screen reading (for example) "Brought to you by Dean Witter". The user is able to select/click on this banner to effectively request more Dean Witter information from program **31**. To accomplish this, the screen view contains a hyperlink formed of the URL for Dean Witter information on the Internet, and program **31** would list the new user as the requester and the current screen view as the page from which he made the request.

In the example, the exchange prices screen view also displays two options: "Quick quotation" and "Build a Portfolio". Say the user selects the former and enters a stock symbol. The screen view also prompts the user to a directory of symbols for use as needed. Near the lower portion of the screen view, there is displayed an area for the user to enter a new stock symbol and an option "button" to effect addition of the corresponding company to the user's portfolio. Also displayed are other selection options as outlined in the Financial Pages formats of Appendix I. Further, main routine **39** displays advertisements in the screen view along the top, bottom and/or sides of the screen as supported by the Page Objects **35***a,b,c* and Ad Package Objects **33***b*.

In response to the user's selection and entered stock symbol, a long URL is generated and received by server **27**. While no page currently exists at the requested address (the URL), program **31** generates one in response. Specifically, main routine **39** queries the Financial Page Object **35***a,b,c* (Appendix I) and requests the standard "quick quotation". The Page Objects **35***a,b,c* assemble the data, format it into a table and return it to Web server **27**. Sources of the data include on-line securities information from S & P Comstock and information stored by Page Data Objects **35***b*.

Simultaneously main routine **39** updates User Action History Object **37***e* to reflect the user's selection of the "quick quotation" option. User Viewing History Object **37***f* notes that the user selected an option which had stock data present in blue, for example, with moving graphical elements.

Also main routine **39** selects and includes advertisements on the newly assembled page/screen view at server **27**. Main

routine **39** accomplishes that by (i) determining, for each Ad Package Object **33***b*, if the advertisements there are appropriate for the user and (ii) ranking all appropriate advertisements. To determine appropriateness, for each ad placed by a sponsor, the sponsor weights demographic and psychographic criteria by importance and identifies which terms are required. The sponsor then gives a minimum total weight required for a user to see the ad series. The weighted criteria and indications of required terms and minimum total weight are recorded in Ad Series Objects **33***c* (FIG. **5***c*).

To rank the advertisements determined to be appropriate, main routine **39** calculates

$$\text{Rank} = \left(\frac{\#\text{hits purchased}}{\#\text{hits achieved}}\right)\left(\frac{\#\text{clickthrus purchased}}{\#\text{clickthrus achieved}}\right)\frac{1}{t}\ \text{cost}(1-D)$$

where #hits and #clickthrus throughs (i.e. number of hits and number of click throughs) purchased and achieved are stored in Ad Package Objects **33***b*;

t is time remaining and equals end date/time minus current date/time (from Ad Package Objects **33***b*); and

D is a percentage discount of the cost of the ad package, if the ad package is not completed i.e., number of purchased hits and click throughs is not met.

In the preferred embodiment, program **31** automates weighting of criteria and in real time adjusts the intended audience profile of advertisements. To that end, program **31** tracks demographic and/or psychographic criteria of users who view ("hit") and/or select (i.e., "click through") advertisements. Then program **31** performs a traditional regression analysis of the tracked criteria, which results in (i) null and alternative hypothesis testing to determine significance (T-test or χ^2 test) of criteria/variables, and in (ii) squared correlation and squared correlation testing (R^2) to determine the weight of each criteria. See D. Freeman, R. Pisani and R. Purves, "Statistics", publishers W. W. Norten & Co., N.Y. 1978 pages 439–444; and Murray Speigel, "Theory and Problems of Statistics," McGraw Hill, N.Y. 1961 pages 270–273. Program **31** uses the T-score (of the T-test) to weight demographic and/or psychographic criteria and to effectively adjust the minimum total weight recorded in the Ad Series Object **33***c* (FIG. **5***c*). Program **31** continually performs the foregoing so as to maximize/optimize success of advertisements displayed through server **27**.

Referring back to the example, server **27** transmits the generated screen view (i.e., "Quick Quotation Page" of user specified company with user appropriate ads) for display to the user. Next program **31** registers the user's activity with the User Interface Object **37***c*, User Session Object **37***d*, and User Viewing History Object **37***f* corresponding to that user. Also User Viewing History Object **37***f* records open and leave times for the first screen view ("Quick Quotation Page" of user-specified company) and notes indications of what elements were displayed in that view to the user. Lastly, an additional "hit" is recorded in the Ad Package Object **33***b* for the advertisements displayed to the user.

When the user requests to add the displayed stock to his portfolio, main routine **39** queries the Financial Page Objects **35***a,b,c* as before and returns (transmits for display) a Stock Page (Appendix I) including an indication of the stock/company the user requested. The User Interface Object **37***c* of the user records the new portfolio information. Where the user provides/enters purchase price to program **31**, the displayed Stock Pages includes a tally of the user's gains and losses.

The user next selects the Weather category. In response, the set of pertinent User Objects **37** register the user's activities (i.e., what he "clicked on") and record indications of the screen view he was viewing as described before. Main routine **39** prompts the user for his zip code or the name of the city for which he wants weather information. In response to the user specified city, the User Object **37***a* for the user records an indication of that city as a city of interest to the user. Further, main program **39** generates a Weather Page Object (Appendix I) through Page Objects **35***a,b,c* to display a weather report for the subject city. This is accomplished in a similar manner to that described above for a Stock Page, but the source of data is one or more on-line services such as Weather Service Corp., Acu Weather, and WSI, for example. As described above, the User Interface Object **37***c*, User Session Object **37***d*, User Viewing History Object **37***f*, and Weather Page Object **35** record (a) open and leave times of the weather screen view, (b) indications of what elements were displayed in that view, and (c) indications of what weather elements the user liked to view in his weather page, including national radar maps and 5-day forecasts.

Say the user now logs out. Program **31** notes the total usage time and adds it to the user's usage log. When the user subsequently logs on, Web server **27** locates his cookie, and main routine **39** queries the User Object **37***a*, User Computer Object **37***b* and User Interface Object **37***c* of the user to identify who he is and what his preferences are. In turn, main routine **39** queries the Financial and Weather Page objects of the user and returns with data (screen views) of that last session. Using this data, program **31** automatically generates a Home Page **43** tailored to the user, i.e., lists his portfolio and the weather in his last specified city.

Also the Home Page **43** displays an option to "click here for weather in other areas". Upon the user doing so and entering a home zip code, program **31** records that information in the User Action History Object **37***e* and User Object **37***a* (home zip code field). Program **31** also generates a Weather Page/Screen View for the designated zip code area using the Page Objects **35***a,b,c* as described above.

Next, say the user selects and uses from the Home Page **43** (i) the Directory to look up a business partner in Detroit, and (ii) the Travel option to look up flight schedules. Screen views of telephone directory pages and travel options/tables are generated and displayed using the Page Objects **35** and Ad Package Objects **33***b* as described before. That is, the Page Objects **35***a,b,c* (i) assemble the data from a pertinent agate source whose URL is passed in the initial request/option selection, (ii) format the data into tables, and (iii) return it to server **27**. Meanwhile the Ad Objects **33***b,c,d* determine and return appropriate advertisements to be integrated into the screen view/page. Moreover, the user's User Object **37***a* records Detroit as another city of interest, and the user's Directory Page Object **35** records his partner's telephone number. Finally, the user's User Interface Object **37***c* records his travel plans (as inferred from the user's activity with the displayed Travel Page/Screen View). User Interface Object **37***c* also sets a flag in program **31** to send the user an appropriate weather forecast the day before he travels.

Preferably, the sources of travel and directory data are: services which compile the subject data for use by program **31** administer, satellite sources, or FM transmission sources. One or more such sources are employed as described above for the Stock Page and Weather page/screen views. Likewise, for Sports data, program **31** utilizes Sports Team Analysis and Tracking Systems Inc., for example. For Classified, Personals and Real Estate data, a collection of on-line services is employed. Alternatively, such data is entered into respective objects by a program **31** administrator. Other data sources or a combination of said sources are suitable.

After some time, i.e., several sessions with program **31**, the user's User Interface Object **37***c* holds indications of his categories of interest, including specific items of interest in each category of information, and his display/format preferences (colors, design, layout, etc.). Based on these recorded details, program **31** constantly and automatically tailors screen views (content and presentation) and advertisement selection (subject matter and presentation) for the user. As such, each time the user logs on, program **31** features items that are more interesting and appealing to him (at least potentially so). When a user selects (i.e., "clicks on") an advertisement, the corresponding Ad Package Object **33***b* records a "click through". This affects the ranking and criteria weighting calculations (discussed above) and further refines the terms of elements to be displayed/presented to a user. Thus the present invention provides a means and method for continually refining the target profile for advertisements.

The messages/notices and warnings feature **45** (FIG. **4***b*) of program **31** enables users to request warnings for all data categories. In the example, say the user requested that a warning be sent to him for changes in stock price of a certain company. In turn, the User Interface Object **37***c* records the user specified threshold (e.g., change in price per share) and his E-mail address where he can be reached. When the stock data source issues a message that meets the threshold, the user's Warnings/Notices Object **45** (FIG. **4***b*) sends an appropriate warning. His Warnings/Notices Object **45** also records a "posting date" of the warning. Upon logging onto his Internet mail, the user sees incoming mail (the warning generated and sent from program **31**). Upon logging into program **31**, the user is presented with the usual Home Page (tailored to that user) but with an indication of an outstanding warning. If the user selects the "warning" option, program **31** employs a "link" (e.g., HyperText technology) to display that part of his stock portfolio which is pertinent to the warning. The Warnings/Notice Object **45** in turn records the user's read date and time.

Similarly, user-to-user messages and/or notices (e.g., special events or new information available through program **31**) are provided to a user. User Viewing History Objects **37***f* and other User Objects **37** may be searched by program administrators to find users to target notices to, depending on category of information and presentation details. For example, if there is a new satellite picture of a hurricane off the southeast coast, a program administrator could search the User Viewing History Objects **37***f* to find all users who have in the past viewed weather maps of the southeast coast. The resulting indicated users can then be sent a notice (via their respective Message/Warnings Object **45**) saying "Check out hurricane X off the coast of Florida (This message brought to you by White Rain hairspray)", for example.

In the case of a sponsor-user logging on, he may browse through the agate information (categories on the Home Page) and advertisements as described above for an end user, but more importantly he is able to place ads and obtain performance reports. This is accomplished as follows. When a company (sponsor) opens an account with the program administer, the program administrator obtains sponsor information and forms a corresponding Sponsor Object **33***a*. Advertising information and desired ads of the sponsor are recorded in respective objects. In particular, package information (number of click throughs purchased, pricing and timing details) are recorded in Ad Package Object **33***b*. Demographic targets are entered in Ad Series Object **33***c*, and the ad content and information are stored in the Ad Objects **33***d*.

As discussed above, sponsors have the ability to place ads according to demographic profile. To do so, advertisers/sponsors complete a template (preferably in the Ad Series Objects **33***c*) which allows them to list certain criteria as required, and to weight other criteria by importance. To ensure ads are shown to the appropriate target users, the sponsor then selects a minimum total weight which a user's demographic/psychographic profile must achieve before the advertisement is shown to the user.

To ensure that sponsors achieve the optimal result from the ads they place, program **31** combines regression analysis with the above weighting technique to achieve real-time, automatic optimization as discussed previously. Under this auto-targeting system, an ad package is shown to general users. After a large number (e.g., 10,000) hits, program **31** runs a regression on a subject Ad Package Object **33***b* to see what characteristics are important, and who (type of user profile) the ad appeals to most. Program **31** then automatically enters weighting information based on that regression to create a targeted system and runs the advertisement (Ad Package Object **33***b*) again in front of this new targeted group. Program **31** then runs a regression every 10,000 hits, for example, including a group of 500 general people as a control, and adjusts the weighting. This continues until the Ad Package is exhausted (i.e., the number of hits and click throughs are achieved).

Subsequently when the sponsor-user logs on, the Web server **27** (using cookies if available) identifies the sponsor-user with a user ID stored in the Sponsor Object **33***a* (FIG. **5***a*). Preferably, separate cookies are used to identify the user's personal login apart from that of the user as an agent of a sponsor-company. Also program **31** begins recording page information for the sponsor, and begins building a demographic and psychographic profile and usage history upon the sponsor-user entering the system.

Using page Objects **35**, program **31** displays an initial screen view and prompts the user for a user name and password. The sponsor-user enters the Company's user name and their password. In response, main routine **39** checks the set of Sponsor Objects **33** and determines this to be the first "visit" since the sponsor placed a new ad. In turn main routine **39** omits displaying the main menu (for sponsor-user) having options to place a new ad, check existing ads, or go to Home Page. Instead main routine **39** uses Page Objects **35** and displays the existing ads section which offers a "reporting" option. Upon the sponsor-user selecting the "reporting" option, main routine **39** lists in a screen view, the standard reports from the corresponding Sponsor Object **33***a* and an option to generate a custom report.

In response to the sponsor's **33** request for (i.e., selection of) a particular report, main routine **39** calls reporting subroutine **41** which queries Sponsor Object **33***a*, Ad Package Object **33***b*, Ad Series Objects **33***c* and Ads Objects **33***d* of the sponsor for details. For example, demographic elements, number of click throughs purchased, number achieved to date, number of hits, and time remaining in an advertisement are retrieved. Program **31** then checks the usage logs and retrieves the profile of users who selected the sponsor's advertisement, using the User Objects **37***a*. The program **31** then generates a report using this data and uses standard statistical regression techniques to find correlation between success and different demographic and/or usage information, and reports those as well. For example, a report comprises several defined elements, including overall success of the advertisement, breakdown by requested demographic elements, comparison of target market with control

group, number of click through requested versus number achieved to date, as well as the time remaining in an advertisement. Finally, program **31** completes a regression analysis using data stored in Ad Package Objects **33***b* and User Objects **37**, and suggests other demographic groups which a sponsor might want to consider for a subsequent ad.

When displayed to the sponsor-user, reports may also have ads integrated therein, similar to pages/screen views displayed to users discussed previously. In the example, say another company previously placed an ad targeting advertisers in the telecommunications industry. When the sponsor-user of the example logs in, the server **27** queries the corresponding Sponsor Object **33***a* for the company's SIC code and industry description. Recognizing a match, program **31** places the other company's ad on the report screen view displayed to the sponsor-user. If the sponsor-user clicks on the ad, program **31** records the hit for the other company's advertisement, just as it would with any other end user. As such, program **31** tracks advertiser usage as user information and develops demographic profiles for advertisers. This data is stored in the sponsor's Users Objects **33***a* (FIG. **5***a*). When the sponsor-user of the example decides to create a second package, the sponsor-user clicks on a "request an ad package" option and completes a form detailing the package (number of hits/click throughs requested, profiling, etc.). This time however the sponsor-user decides not to identify a target market for this ad. Impressed by the system's regression information, the sponsor-user decides instead to choose "auto target" and allow program **31** to make the most efficient use of the new ad. Graphics of the new ad are "pasted" onto the form and submitted to server **27**.

In response, program **31** creates a new Ad Package Object **33***b* and links it to the company's existing Sponsor Object **33***a*. From the data entered into the form, main routine **39** completes the corresponding Ad Package Object **33***b*, Ad Series Object **33***c* and Ad Object **33***d*. In turn, program **31** displays a price quote for running the ad, and the sponsor-user clicks on the "accept" button. This advertisement package becomes available as soon as the sponsor-user has clicked on the "approved" button.

Subsequent login to program **31** completes a similar query to the one above, this time checking for both of the sponsor's advertisements. Reporting subroutine **41** generates a report listing the successes of the ads in two columns of a table. To accomplish this, subroutine **41** uses Sponsor Object **33***a*, Ad Package, Ad Series and Ad Objects **33***b*, **33***c* and **33***d*.

Say, for example, the sponsor-user decides to follow the success of this new ad and creates a customized report to do so. To build the report, the sponsor-user clicks on the "build custom report" option. Here subroutine **41** sends a report template to the sponsor-user. The sponsor-user selects the new ad series, which promoted a second telephone line for example, and requests a variety of reporting elements. The sponsor-user then names the report "Susan 1". The completed report information is stored in the Advertising Reporting Features Object (Appendix IV). The name of this report will now appear on the report options list of the sponsor when a sponsor-user subsequently logs on.

Program **31** automatically breaks down "auto-targeting" advertisements by time, to demonstrate the increasing success of the ad. The system prepares any requested report with this time breakdown, such that a sponsor can see that the advertisement is becoming more and more successful the longer it runs.

In the preferred embodiment, program **31** allows sponsors to sort groups of users by demographics, to compare success rates of different user groups, advertisements, advertisement aspects, etc. The above described methods employed by subroutine **41** and program **31** provide graphical reports when appropriate and format report data in a manner which is easily printable or transportable to presentations software. For example, in the preferred embodiment, program **31** makes all reports downloadable as an Adobe Acrobat file. Other formats are also suitable.

In order to achieve rapid and direct benefits from the detailed reporting of program **31**, program **31** allows the sponsor to enter new advertising contracts on line. If a sponsor recognizes that, for example, 25–35 year-old women tend to purchase frequently and respond to their still, forest green colored advertisements most often, program **31** allows sponsors to place that type of ad in front of the subject target market segment during a reporting cycle. Thus, program **31** enables updating of the Sponsor and Ad Objects **33** during a reporting cycle to accommodate the foregoing.

With respect to reporting, if the reports of program **31** show that customers respond to still advertisements more often than moving ones, bright colors more often than darker ones, graphics rather than text, large text rather than small, detailed text or square advertisements rather than bar style ones, such is relayed to the sponsors/advertisers.

To achieve the foregoing analysis, program **31** classifies aspects of each advertisement (see Ad Objects **33***d*, FIG. **5***d*). In a preferred embodiment, such classification is automatically provided by a subroutine of main routine **39**. In turn, this allows direct user behavior analysis and psychographic profiling.

Equivalents

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

For example, the term "page" is used synonymously with screen view.

In the foregoing discussed example, description of generation of weather, stock, travel and directory pages is provided. Page/screen view and supporting objects in other categories of information are similarly generated.

The use of the term "program administer" singularly or in plural is intended to refer to people who operate the Web site of program **31**, or the functional equivalent.

Further, other features, such as the following, may be implemented in program **31** with respect to a respective category of interest.

Stock & Business Data

Perhaps the greatest value added by this section is portfolio accounting. By letting users enter stocks, purchase price, commission, and number of shares, program **31** allows users to track their investments more successfully. In addition to the portfolio, program **31** may provide users an option to create a list of stocks that they follow (i.e., without any of the purchase information), simply so they can separate what they own from what they might buy. Both of these lists are downloadable into Quicken, MS Money, or generic, tab-delineated spreadsheets.

As described above, however, program **31** allows users to be able to build portfolios, initially without registering, etc. Thus it is important to allow users to view detailed stock information for individual companies or groups of companies without building a portfolio. An alternative is display-

ing in Financial Pages several blanks in which users can place company symbols, with check boxes for the options of "Add these to my Portfolio" or "Add these to my 'Follow these' list".

Company data will also be a major competitive advantage of program **31**. Program **31** allows users to examine company data, compare several companies, or compare an SIC-code group, all with a few clicks. Example: Joe Cool wants to compare Apple, IBM, and Compaq. Joe could enter these three into the same blanks used for stock data and, instead of stock data, select corporate information. Joe would receive from program **31** the balance sheets, income statements, etc., all in comparable columns. Joe could also switch to CAGR numbers (Compound Annual Growth Rate, pre-processed by program **31**) which allow easier comparisons. Another click (i.e., command/selection) and Joe downloads these as a spreadsheet.

Both stock and company data can also be processed through a few calculations to produce standard business ratios (i.e., price-to-earnings, etc.). Some of these can be pre-processed; some must be done in real-time as they include stock price.

Alerts: For users who are comfortable giving out their E-mail address, the program **31** will send alerts at preset stock prices for stocks in their portfolio list or their "track these" list. E-mail's will be sponsored and will correspond to the "New Items" section on a user's personal page.

Weather

Program **31** uses the weather to determine, in part, where users live and where they are going. As such, program **31** enables users to see the weather in 1, 2 or 3 places they are or would like to be. Thus, another program feature allows users to view weather from more than one place simultaneously.

Program **31** typically gives users a quick glimpse at the 5-day forecast on the login page, with additional information about their local area or others in map format, graphical images (e.g., a snowflake), and data. Weather summaries may be available (short text blurbs) for larger regions, and possibly for individual cities.

The greatest challenge here is how to locate the user. This can be done either with maps, zip codes/postal codes or by city (selectable lists which change by country). Alternatively, it is desirable to have a clickable map which allows the user to get to their location within 2 clicks. Also the system may offer a shortcut where the user can do it by postal code (and have a global database of postal codes). If postal codes duplicate, let the user select from the possible options.

Alerts: Users will be able to request alerts of bad or good (e.g., for weekend plans) weather in their area via E-mail.

Sports Stats

The sports section probably requires the most tailored display capabilities. Users will be able to find game results (broken down by inning/quarter, etc.), league standings, individual player information (RBI, runs, At Bats, etc.) and retrieve some set of these each time they look at sports stats. This will be a natural lead-in to a rotisserie league and will support franchise sites (a good cross-link opportunity). The Web site will also include betting lines.

Initially, users will be welcomed to a site featuring a graphic that represents all of the sports that program **31** covers and the previous day and current day's results, and can select the sport that interests them most, or go immediately to a game of interest. If a sport is selected, program **31** will present teams—or players, if the sport is an individual sport—(organized by standing in leagues, or as is otherwise appropriate by tradition), and allows users to click-through the league or a specific team. At this level (league, team or individual) and on all subsequent levels, the system will allow the user to "track this team" or "track this player."

The next time a user logs on to sports, a screen will compile the user's information, showing all baseball teams (including win-loss record, league, league standing, next game date and time), then all baseball players, etc.

Alerts: program **31** will alert users when their favorite teams are on television or coming to town.

Travel Information

Travel information will include various modes of travel, their schedules (departure/arrival times, perhaps including layovers/transfers), and, when available, costs for tickets (by class) and, if possible, ticket availability information. This is a natural lead-in to on-line bookings. Preferably, program **31** accommodates additions of new carriers and perhaps a section on hotels.

Where possible, program **31** would give users the cost of a seat on that flight, and availability of seats in a specific category.

Alerts: Users will be alerted to weather in towns they are traveling to, airport closings, etc. (Weather Objects may include this.)

Telephone Directory

Users will be able to define a name (first, last), address (city, state, zip), and find all published numbers that match (limited to 100/display, but users can go through more than 1 page of 100). Entire lists can be downloaded into a tab-delimited file with name, address and phone. Users can keep a directory of most called numbers on server **27**. Users will receive alerts if someone on their list is no longer listed at the old address.

Visitors to server **27** will have the ability to add E-mail information to their directory information. This will be recorded so long as they maintain the same location. It they move, they will have to re-enter their E-mail address.

Program **31** will also maintain a list of "where are they now" numbers and addresses, i.e., a list of changed addresses and telephone numbers which is searchable in a similar fashion.

Media (TV & Film) Schedules

Users will be able to find television (network and local) and film schedules by zip code. Users will also have the capability to search for a specific'show or film (to see where and when it is playing) or national network/satellite channel, or theater (to see what they are playing).

These lists will feature, in bold, the names of films/shows appearing from any sponsor. Users will have the option of tracking specific channels/themes on their Main (Home) Page **43** or on an adjunct Media-Page.

Classifieds & Personals

Users will have the ability to enter classified and personal advertisements on the network. Program **31** will use the information provided to build demographic profiles when possible.

Entry should be through automatic forms and selectable lists as much as possible, to enable quick search and classification. Users should be able to browse through categories of items, or search them. Classifieds should be searchable by category, model, condition, price, seller's location, and keyword. Personals should be searchable by location, price, gender, orientation, race (if declared), age, and other categories.

To respond to a list, server **27** should allow responders to send a confidential message to a user or program **31**,

including his/her program identifiers, E-mail address, or telephone number. When someone who posted an advertisement/personal next logs-in, his/her Home Page **43** should contain a message reading "You have responses to your ad!" This hotlink should lead users to a page containing all responses and allowing the user to send simple messages in reply.

Entries, if not renewed, should be removed after two weeks. Users should be able to renew and remove advertisements easily, perhaps by entering a system-provided code.

Reports

Sponsor-user requested reports are generated at the time of request as described above. A real-time report (e.g., JAVA format) would show changes as they occurred during a requested report.

APPENDIX I

Types of Financial Pages
Format 1. Stock Page
Top banner
Portfolio
Table including user-selected stocks and items listed below
Items included in a table
Last Traded At . . . price
Day/Time of last trade
$ change
% change
volume
trades
open
prev. close
bid
ask
day low
day high
52 week low
52 week high
EPS
P/E
Market Cap
Beta
Dividend
Dividend Ex Date
5 year EPS growth
Currency
Per share purchase price
Number of Shares purchased
Change in individual share value
Change in share lot value
Total change in portfolio value
Portfolio value graph
Message Window
List of quickly moving companies/alerts
List of expert articles
Tracking List
(like portfolio, replacing purchase price with "initial tracking value")
Indices (graphed, listed or value by daily change pointer)
Dow Jones Industrial Average
NASDAQ
Other indices
Custom Ticker
Closing Banner
Format 2. Company Page
Top Banner
SIC Industry code and industry name
Stock information
Graph of change
Table compares these with 3–5 companies in similar SIC group
Last traded at . . . price
Day/time of last trade
$ change
% change
volume
trades
open
prev. close
bid
ask
day low
day high
52 week low
52 week high
EPS
P/E
Market Cap
Beta
Dividend
Divident Ex Date
5 year EPS growth
Currency
Per share purchase price
Number of shares purchased (if user holds in portfolio)
Change in individual share value
Change in share lot value
Corporate information
Industry overview
Products
Officers and contact info for them
Historical balance sheet and income statement Tables
Link to 10K/10Q
Window—News/Expert articles on that company
Closing banner
Format 3. Expert Articles Page
Top banner
Article (may include tables/links to company data)
Stock graph for companies discussed
List of previous articles (with links)
Bottom banner
Format 4. Expert Guide Page
Top banner
Survey pages
Results page
Textual description of stock page
Table of some stocks that they found to fit their description
Description of "Show me Some" stock option (see below)
Disclaimer
Bottom banner
Format 5. Show Me Some Page
Top banner
Text description of what page does

- Table of stocks (generated from where the call for the page came from)
- Disclaimer
- Bottom banner

Types of Weather Pages

Format 1. National Weather Page

- Top banner
- Maps
  - National/Continent Weather Photos & Maps
    - Satellite view
    - Temperature changes
    - Precipitation map
    - UV index
- Textual description of the fronts
- Real audio from a celebrity reading his/her forecast
- Bottom banner

Format 2. Regional Weather Page

- Regional (state-sized regions) photos & maps
  - Satellite view
  - Temperature changes
  - Precipitation map
  - UV Index
- 5-day graphical forecast
  - high temp
  - low temp
  - precip (sunny, partly cloudy, partly sunny, mostly cloudy, cloudy, rain/snow)
- Detailed 5 day forecast (table & text)
  - high temp
  - low temp
  - winds
  - wind chill
  - precip
  - UV index
  - textual description
- Weather warnings
- Bottom of the page ad

Types of Sports Pages

Format 1. Sports Page (General Sports Page)

- Top of page ad
- Game scores by league (user drill-down to game page)
  - 4 pros and 2 collegiate
- Standings in league
  - 4 pros and 2 collegiate
- Player standings by major category (for pros 4 and college 2)
  - Baseball
  - Football
  - Hockey
  - Basketball
- News window for each sport showing recent (e.g., 2–3 days worth of news) with link to News Page for more.
- Custom scores ticker

Format 2. News Page (windows will be Java scrolling including new news where possible)

- Top ad
- Major trades/signings
- Injuries
- Other news windows
- Bottom ad

Format 3. Team Page

- Top ad
- Team name
- Team logo (if permission granted)
- Roster
  - Player names
  - Player numbers
  - Player position
  - Short stats list
- Bottom ad

Format 4. Team v. Team Page

- Top ad
- Table—2 columns
  - Team names & team logos (if permission for BOTH)
  - Team rosters, with players opposite one another
  - Performance stats in competition
- Odds-makers bets on coming games
- Ticker with game scores for entire season
- Bottom ad

Format 5. Player Page

- Name
- Team name
- Position
- Stats list
  - Runs scored (season)
  - RBI
  - Batting average

Format 6. Player v. Team Page

- Top advertisement
- Player name and team name
- Player stats against this team only (table)
- Odds of various events in table
- Bottom ad

Format 7. Player v. Player Page

- Top advertisement
- Table with two columns
  - Player names
  - Relevant stats in previous matches
- Odds in table

Media Schedule Page

- TV Table
  - Show
  - Channel
  - datetime start
  - datetime end
  - rating
  - rerun?
- Film Table
  - Film name
  - Director
  - primary actors (3)
  - theater
  - times
  - length
  - rating
  - comedy/drama/action/documentary/musical classic/new film
- Theater/Opera/Symphony Table
  - Theater
  - Show title
  - Show times
  - Director

Travel Options Page (by City)

- Advertisement (Top)
- Table with travel options
  - Transport type

- airline
- bus
- boat
- train
- Schedule
  - Departure
    - city
    - time
  - Stops (could be multiple)
    - city
    - arrival time
    - departure time
  - Arrival
    - city
    - time
  - Reservation Information
    - seats available
    - cost/ticket
    - restrictions
    - requirements
      - passport?
      - visa
      - photo ID
    - number to call for reservation
  - Table with room and board options in destination
    - Hotels
      - name
      - address
    - price/night
      - weekday
      - weekend
    - max # in room
    - bedding
      - king (number?)
      - queen (number?)
      - single (number?)
      - cot (number?)
    - television
    - cable TV
    - pool
    - a/c
    - number to call with reservation
  - Rental car options
    - Dealers
      - name
      - address
      - telephone
    - Car options (for days available)
      - make/model
      - price/day
  - End of page ad
- Personals Page (result of search by categories)
  - Top of Page Ad
  - Table comprising search results
    - geographic
      - city
    - demographic
      - gender
      - age
      - income bracket
      - occupation
    - lifestyle
      - language
      - smoker
      - orientation
      - lifestyle (vegetarian)
      - race
      - drinker
      - marital status
      - music
      - weight
      - height
    - Ad text
  - End of page ad
- Classifieds Page
  - Beginning of page ad
  - Response from search
    - Item name
    - Make
    - Model
    - Price
    - Year
    - Available date
    - Description
  - End of page ad
- Real Estate Pages
- Format 1. Citywide Listings Page
  - Beginning of page ad
  - Table showing
    - address
    - price
    - dwelling type
    - square footage
    - price/sq.foot
  - End of page ad
- Format 2. Selected Listings Page
  - Top Ad
  - Table (includes only those listings selected by the user)
  - Table including
    - address
    - price
    - square footage
    - price/sq.foot
    - dwelling type
    - eat-in-kitchen (EIK)?
    - number of bedrooms
    - number of baths
    - parking?
      - number of off street
      - number of garage
    - yard size (if any)
    - deck?
    - pool?
    - construction type (brick, wood, etc.)
    - heat type
    - central air?
    - available date
  - Bottom ad
- Format 3. Individual Listings Page
  - Beginning of Page Ad
  - Table including
    - address
    - price
    - square footage
    - price/sq. foot
    - dwelling type
    - eat-in-kitchen (EIK)?
    - number of bedrooms
    - number of baths
    - parking?
      - number of off street
      - number of garage

- yard size (if any)
- deck?
- pool?
- construction type (brick, wood, etc.)
- heat type
- central air?
- available date
- Textual Description
- Contact information for house
  - Owner/agent name
  - telephone
  - E-mail/program 31 messaging
- Photo (if paid advertisement)
- Floor plan (if paid advertisement)
- Map of city with house marked (using 9 digit zip)
- End of page ad

APPENDIX II

- City Pages
  - Travel Options from User's Hometown
    - See Travel Options Page above
  - Media/Cultural Event Schedules in Table
    - Name of event/show
    - location/channel
    - datetime begins
    - datetime ends
    - ticket cost (if any)
  - Corporate Information for Local Companies (Table)
    - Name
    - Industry
    - Revenues
    - Contact Info
      - street address
      - city
      - state
      - zip
      - telephone
      - fax
      - E-mail
  - Weather
    - graphical 5-day forecast for city
  - Directory (numbers in city user has accessed before)
    - Name
    - Address
      - street
      - city
      - state
      - zip
    - Telephone
    - fax
    - E-mail
    - Notification of changes in address list

APPENDIX III

- User Customized Categories
  - Financial Information
    - Data from two primary sources
      - S&P Comstock from variety of exchanges.
      - (Note some of these items may not be available.)
        - last traded at
        - day/time of last trade
        - $ change
        - % change
        - volume
        - # trades
        - open
        - prev. close
        - bid
        - ask
        - day low
        - day high
        - 52 week low
        - 52 week high
        - EPS
        - P/E
        - Market cap
        - beta
        - Dividend and ex
        - 5 year EPS growth
        - currency
      - Ticker-company translator
      - EDGAR
        - revenues
        - earnings
        - product descriptions
    - Preformatted data analysis for user profiles
      - bid
      - ask
      - last
      - $ change
      - 52 wk high
      - 52 wk low
      - p/e
    - Portfolio view—user selected stocks
      - current information
      - tabular (selected attributes)
      - total value if user includes # shares
      - changed value if user includes purchase price;
        - allow multiple purchases of same stock for several different purchases by doing Quicken-like pull-down entry for several lots of same stock
      - user formatted output
      - value-added analysis tools and data
        - Prepared analytical views for user selected data. Includes customized info . . . here's my data and here are some forms of analysis. Options range from numeric to "Thumbs-up, Thumbs down".
          - What info do you want
            - e.g., Dorfman's ratings (for every stock; based on designated user goals and profiles)
            - trip next year
            - college
            - retirement
            - what items do you like?
            - e.g., Beardstown ladies What businesses are doing well in your neighborhoods? What shoes are your kids wearing?
        - Prepared profiles to assist users in selecting data. I give you my easy walk-through analysis and you give me the data that fits it (I want college stocks and you suggest them).
          - Like TurboTax software
          - ADD info from here to user profile
        - Direct User Selection of categories and display (like TERMS)
    - Sports
      - Sports stats
        - initially for big 4 professional leagues eventually adding college and golf, tennis, auto and horse racing
      - preformatted data packages include
        - daily report on selected team/player stats

value-added analysis tools and data
Prepared analytical views by experts. Program administrator will try to get sports personalities from major cities nationwide as well as a few national sportscasters. The program administrator will allow users to follow those they find compelling.
What info do you want
Sports personality ratings (for every team; based on what Terry believes is important, for the teams the user likes)
e.g. by Dan Deardorf
by Stan Savrin
by Terry Bradshaw
includes the categories important to the analyst and their thumbs-up or thumbs-down stat
overall rating by Dan defensively, etc.
Prepared profiles to assist users in selecting data. I give you my easy walk-through analysis and you give me the data that fits it (I want football teams and a simple comparison, you suggest them).
walks through important stats and what they show; allows user to select teams; prepares standard profiles for selected teams, including basic analysis
Direct user selection of categories and display (like TERMS)
user chooses categories
user chooses teams
program **31** builds grids
Warnings:
when team is on TV channel (allow user to select networks that are available); when team is coming to town; when major news events (trades, etc.) occur

Weather
data from single provider
includes city-by-city and airport reports and projections
includes zip-code locator for cities
includes graphical files prepared by data supplier
locator map
allows users to click to locate
increasingly accurate maps global in scope result in location that links to local weather data.
description by expert(s)—lets user view how Joe Denardo or Willard Scott views the weather and why.
Prepared profiles to assist users in selecting data.
Very simple for weather: helps users to select their area and what weather items interest them. Emphasizes ability to select "weather warnings" from the system.

Direct User Selection of categories & display (like TERMS) Warnings/Notices
Severe weather in their area or other areas they monitor
Good weather coming in potential vacation spots

Travel
data
centered on "from:" and "to:" cities include schedules, pricing and seating class availability for airlines, buses and trains
preformatted data packages
allow user to simply select two cities (airports), date and time (optional) of travel, and view their travel options.
Sortable by time, cost, seating available value-added analysis tools and data
Featured travel packages prepared by travel experts
Prepared profiles to assist users in selecting data
Easy walk-through analysis and program **31** gives the data that fits
What city are you in?
Where do you want to go?
When do you want to travel?
What's your greatest priority?
cost
convenience
non-stop
ADD this information to user profile
Direct user selection of potential flights warnings/notices
discount fares to cities the user has examined;
poor travel conditions to cities the user has examined;
fares falling below a certain point to cities the user has selected

Telephone
Includes telephone, address and allows user to add E-mail and URL value-added analysis tools and data
Allows user to send E-mail (when listed) directly to another user;
Allows user to build list of regularly used numbers and addresses (automatically generated from selected data);
Prepared profiles to assist users in selecting data;
Helps users to limit searches so they will be most effective
ADDs info from here to user profile quick look-up feature (just give last name, first initial and state) detailed searching: allows all users to search by name, address, E-mail, etc. warnings:
when information changes that is listed in user list

Personals
data entered by users
data entry uses preformatted forms with many optional categories
value added analysis tools and data
Prepared analytical views for user entered profiles from Dr. Ruth to Oprah.
What kind of a person are you? What do you want?
Oprah's ratings (based on which items Oprah thinks are important)
age
smoker/non
cook?
Prepared profiles to assist users in entering data and giving importance to their data items.
Easy walk-through analysis
Helps users to input their info (automatically lists them on network if they like, allowing anonymous entries and replies)
Completes search
Helps user send message
Direct user selection through browsing or complex searching
Warnings/notices
responses to ads placed
"most interesting singles ad of the week"
Oprah's latest recommendation for you

Classifieds
data entered by users
data entry uses preformatted forms with many optional

categories (depending on product selected)
product
cost
size
weight
doors (2 or 4)
horsepower
cylinders
negotiable?
manufacturer
age/year of purchase
warranty?
location of item
text description
value-added analysis tools and data
Prepared analytical views for user entered profiles, from CarTalk to other industry experts.
What do you want? What are your priorities?Car Talk ratings on makes, models, etc. for autos, and other experts on other categories: CONSUMER REPORTS?
price
year
make/model
Prepared easy walk-through category selection
Helps users to select items they want, identifying and sorting by their most critical categories
Completes search
Helps user send message
Direct user selection through browsing or complex searching
Warnings/Notices
responses to ads placed
bidding/counter-bidding process

APPENDIX IV

Advertiser Reporting Features
Web-based reporting includes advertisements targeting the advertisers
Please contact me . . . I want to advertise on server **27**
Place/delete ad packages (for existing accounts only)
Reporting
Allows drill-down through to individual user level
Types of Reports
1. Overview of program **31** advertising
Broken down by ad packages
Shows
HTs purchased and achieved
CTs purchased and achieved
Purchases (if applicable)
Cost of package
Date specified by package
Can click through to detailed package reports
2. Detailed Package Reports (for individual packages)
Shows ads included in package
Media (visible/playable here)
HTs purchased and achieved
CTs purchased and achieved
Purchases (if applicable)
Cost of package
Demographic profiling requested
Demographic breakdown of success v. control group
3. Demographic Response Rates
Includes all packages or selected ones
Compares (if several) ad success by demographic groups selected as important to advertiser
Automatically runs regression in background and suggests other demographic characteristics that are important factors in CTs and/or purchases
Allows advertiser to auto-generate a complete regression report for a specific package, subset of packages or all packages.
4. Psychographic Profiling
Includes all packages or selected ones
Compares (if several) ad success by psychographic groups selected as important to advertiser
Automatically runs regression in background and suggests other demographic characteristics that are important factors in CTs and/or purchases
Allows advertiser to auto-generate a complete regression report for a specific package, subset of packages or all packages.
5. Mapping (U.S. or world locations)
Generates map to show program **31** user density v. the sponsor's CT or purchase density
Allows scalability
6. Regression (demographics)
7. Custom reports
Very like TERMS
Advertiser selects packages to analyze
Advertiser selects variables to consider
System generates reports
Custom reports can be caved on server **27**

I claim:

1. In a computer network formed of a communication channel and a plurality of digital processors coupled to the communication channel for communication thereon, computer apparatus for initially creating a psychographic profile of a user comprising:

a data assembly for providing and supporting display of agate information to users of the computer network, in response to a user request the data assembly transmitting requested agate information across the communication channel to one of the digital processors for display of the requested agate information and viewing by the user; and

a tracking and profiling member responsive to the data assembly upon display of the requested agate information, in response to a user viewing requested agate information obtained through the data assembly, the tracking and profiling member recording indications of physical activity by the user during viewing of the displayed requested agate information, said physical activity being with respect to the displayed requested agate information and including user response to the displayed requested agate information, such that said recorded indications of physical activity by the user generates a psychographic profile of the user.

2. Apparatus as claimed in claim **1** wherein the agate information provided by the data assembly includes at least one of stock and market data, theater and television schedules, sports statistics, weather information, travel information and Directory information.

3. Apparatus as claimed in claim **1** wherein:

the tracking and profiling member records format preferences of users with respect to presentation of certain agate information, the format preferences including color schemes, text size and shapes; and

in response, the data assembly displays agate information to a user (a) in a manner customized according to the format preferences of the user and (b) having contents corresponding to the psychographic profile of the user.

4. Apparatus as claimed in claim 3, wherein the tracking and profiling member further records demographic information of the user such that demographic profiles of users are provided and the data assembly further displays agate information to a user according to demographic profile of the user.

5. Apparatus as claimed in claim 1 further comprising an advertising component coupled between the data assembly and tracking and profiling member, the advertising component holding a plurality of advertisements to be displayed to users on the network, in accordance with the psychographic profiles of the users, and for each advertisement, the advertising component providing a target profile of desired users to whom to display the advertisement.

6. Apparatus as claimed in claim 5 wherein the tracking and profiling member further provides demographic information about a user; and for each advertisement, the data assembly transmits the advertisement for display with agate information to users having a psychographic profile and a demographic profile substantially matching the target profile of the advertisement to provide targeted marketing.

7. Apparatus as claimed in claim 5 wherein the advertising component further records history of users viewing the advertisements, including for each advertisement, at least one of (i) number of times viewed by a user, (ii) number of times selected for further information, and (iii) number of times a purchase was obtained through the advertisement.

8. Apparatus as claimed in claim 7 further comprising a subroutine coupled to the advertising component for performing a regression analysis on the history of users viewing the advertisements, and therefrom the subroutine refining the advertisement target profiles of desired users to whom to display the advertisements.

9. Apparatus as claimed in claim 8 wherein for each advertisement, the subroutine includes performing a regression analysis and refining the target profile of the advertisement upon a user viewing the advertisement, such that the target profiles of the advertisements are refined in real time.

10. In a computer network formed of a communication channel and a plurality of digital processors coupled to the communication channel for communication thereon, a method for initially creating user profiles comprising the steps of:

providing and supporting display of agate information for viewing by users of the network;

for each user, during user viewing of agate information, recording indications of physical activity including response by the user with respect to agate information being viewed by the user;

from the recorded indications of physical activities and responses of the user, creating user profiles of the users, each user profile providing an indication of categories of interest to the user and display preferences for each category.

11. A method as claimed in claim 10 wherein the step of providing and supporting display of agate information includes providing and supporting display of at least one of stock data, media schedules, sports news, weather information, travel information, and directory information.

12. A method as claimed in claim 10 wherein the step of providing and supporting display of agate information includes displaying advertisements to users by (i) providing advertisements, (ii) for each advertisement, providing a target profile of desired users to whom to display the advertisement, and (iii) for each user, comparing user profile to target profiles of the advertisements and displaying advertisements having target profiles substantially matching the user profile.

13. A method as claimed in claim 12 wherein the step of recording further records user viewing activity with respect to displayed advertisements; and further comprising the step of continually refining target profiles of desired users to whom advertisements are to be displayed by (a) performing regression analysis of recorded user viewing activity with respect to each advertisement, and (b) for a given advertisement, weighting importance of target profile characteristics based on the regression analysis such that the step of comparing finds a substantial match between a user profile and the target profile upon a total score of the target profile characteristics that match characteristics of the user profile meeting a predefined threshold.

14. In a computer network formed of a communication channel and a plurality of computers coupled to the communication channel for communication thereon, a method for defining profiles of target users comprising the steps of:

(a) providing a source of displayable information, the source holding a multiplicity of pieces of information;

(b) for each of certain pieces of information in the source, setting respective initial profiles of target users to receive the certain piece of information;

(c) transmitting each of the certain pieces of information across the communication channel such that each is displayed only to users having a profile substantially matching the respective initial profile of the certain piece of information;

(d) recording computer activity by users during display and user viewing of the certain pieces of information, said computer activity including physical activity and response by the user during viewing of the certain pieces of information;

(e) redefining the initial profiles of target users based on a regression analysis of the recorded computer activity of users, said redefining forming respective adjusted profiles of target users for each of said certain pieces of information; and

(f) continually repeating steps (c) through (e) with the adjusted profiles of the certain pieces of information, such that the certain pieces of information over time, become better targeted to users having an interest in said information and hence said method is self-tailoring.

15. A method as claimed in claim 14 wherein the step of providing a source of displayable information includes providing agate information.

16. Method as claimed in claim 15 wherein the step of transmitting includes displaying to users agate information in real time of events generating the agate information.

17. Method as claimed in claim 16 wherein the step of transmitting and displaying includes displaying agate information in predefined schedules to coordinate with at least one of television and radio broadcast of events generating the agate information.

18. Method as claimed in claim 16 wherein the step of displaying agate information further includes updating of the information, in real-time of the events generating the agate information, in a manner such that the agate information is viewable alongside television viewing of said events.

19. A method as claimed in claim 14 wherein the step of providing a source of displayable information further includes providing advertisements as the certain pieces of information.

20. A method as claimed in claim 19 wherein the step of setting respective initial profiles of target users includes allowing sponsors of the advertisements to indicate relative importance of demographic and psychographic criteria of target users.

21. A method as claimed in claim 20 wherein the step of redefining the profiles of target users includes using the regression analysis to weight importance of the demographic and psychographic criteria of target users.

22. A method as claimed in claim 21 wherein the step of transmitting includes (a) determining appropriateness of each of the certain pieces of information with respect to each user, by matching the weighted demographic and psychographic criteria to characteristics of the profile of the user, upon a total score of the matching meeting a predefined minimum desired score, the piece of information being determined to be appropriate for the user; and (b) ranking the certain pieces of information determined to be appropriate with respect to a user such that said ranked certain pieces of information are transmitted in order to the subject user.

23. A method as claimed in claim 22 wherein the step of redefining profiles of target users is performed in real time of subject users viewing the certain pieces of information, such that the step of determining appropriateness constantly updates which of the certain pieces of the information is to be transmitted to each of subject users.

24. A method as claimed in claim 19 further comprising the step of reporting the continually adjusted profiles of target users of the advertisements and user profiles to whom the advertisements have been transmitted, said reporting being accomplished during the continual repeating of steps (c) through (e), such that said reporting is in real time of users viewing the advertisements and the adjusted profiles being redefined.

25. A method as claimed in claim 24 wherein the step of reporting includes displaying to sponsors of the advertisements, characteristics of the adjusted profiles each time the profiles of target users is redefined, such that sponsors are able to view in real time the advertisements becoming better targeted.

26. A method as claimed in claim 14 wherein the step of recording builds psychographic profiles of users; and

the step of redefining is further based on a regression analysis of the psychographic profiles of users as recorded in the recording step.

27. A method as claimed in claim 14 wherein the step of redefining the profiles of target users includes performing the regression analysis in real time of users viewing and interacting with the certain pieces of information, such that the profiles of target users are redefined throughout transmission and display of the certain pieces of information in the computer network.

28. A method as claimed in claim 14 further comprising the step of defining, for each user, a user profile based on the recorded computer activities of the user with respect to pieces of information viewed by the user, each user profile indicating preferences in content and presentation of information to that user, said step of defining a user profile including determining the user profile upon user interactivity with displayed information, through input means coupled to a computer, coupled to the computer network.

* * * * *